COMMUNICATION EQUIPMENT

SSB MF/HF RECEIVER R 201 AND R 201 SPECIAL

DANISH MARINE COMMUNICATION A/S
DENMARK
PHONE 08-37 19 22 . TELEX 69 840 dk
SØRUP. DK-9530 STØVRING

DANCOM receivers R 201 and R 203

DANCOM R 201 and R 203 are radio communication receivers intended for MF- and HF marine communication and general purpose radio reception.

Both the R 201 telephony receiver and the R 203 main receiver have built-in power supply for 24 VDC and 110/220 VAC operation.

The receivers are continuously variable from 10 Khz to 30 Mhz in 30 bands.

DANCOM R 201 and R 203 are intended for telephony- (SSB) telegraphy- and telex communication.

TECHNICAL DATA

Modes of reception:	A1,A2,A3,A3H,A3A,A3J (F1 as option)
Frequency range:	10 KHz - 30 MHz in 30 bands 500 and 2182 KHz in 2 fixed positions
Sensitivity:	AM: 3uV for 10 dB s/n CW/SSB: 1uV for 10 dB s/n (bandwidth 3 KHz)
Antenna input:	10-250 pF from 10 KHz-4 Mhz 50 ohm from 4-30 MHz
Frequency stability: frequency inconstancy in any 5 min. period with constant ambient temperature	< 50 Hz (long term)
10 KHz-30 MHz	< 20 Hz

Selectivity:

position	-6 dB	-60 dB
Wide	> ±4000 Hz	< ±20 KHz
R203 Intermediate	> ±1000 Hz	< ± 6 KHz
R203 Narrow	> ± 500 Hz	< ±3,5 KHz
R203 Very narrow	< ± 200 Hz	< ± 2 KHz

SSB min.pass-band:

6 dB at +350 Hz to 2700 Hz

SSB min. attenuation:

60 dB at -500 Hz to 3800 Hz

Cross modulation: with a wanted signal 60 dB above 1 uV the interference produced by an unwanted signal 10 KHz off-tune and 90 dB above 1 uV will be more than 30 dB below standard output

Intermodulation: with a wanted signal 30 dB above 1 uV, 2 unwanted signals, whose sum or difference frequency equals that of the wanted signal, must each be of a level 80 dB above 1 uV to produce standard output

T E C H N I C A L D A T A

Blocking:	with a wanted signal 60 dB above 1 uV, an interfering carrier 10 KHz off-tune must be of a level exceeding 100 dB above 1 uV to affect the output by 3 dB
Image rejection:	10 KHz - 1.6 MHz >70 dB 1.6 MHz - 18 MHz >70 dB 18 MHz - 30 MHz >70 dB
Intermediate frequencies:	1st i.f. = 45,1 MHz 2nd i.f. = 580 KHz
I.f.-rejection:	>60 dB up to 1.6 MHz >90 dB above 1.6 MHz
I.f.-output:	20 mV into 50 ohm for 2 uV carrier at antenna input
Bfo (R203):	$\pm$3 KHz (with fine-tuning)
Clarifier:	$\pm$200 Hz
AGC Characteristic:	output is maintained within 6 dB for a change in input of 90 dB from 3 uV reference level
AGC time constant:	mode attack release A1/A2/A3 10 m sec 0,15 sec SSB 10 m sec 2,00 sec
Audio output: loudspeaker lines earphones	 4 W into 3.2 ohm (distortion: 5%) 10 mW into 600 ohm balanced 1 mW into 2000 ohm
Audio response:	$\leq$ 3 dB (300 Hz - 4 KHz)
Radiation:	typically 20 x 10^{-12} watts max. 400 x 10^{-12} watts
Meter:	to read signal level
Power supply:	24 Vdc battery $\pm$10% and 110/220 Vac $\pm$ 10% 50-60 Hz
Power consumption:	app. 80 VA
Dimensions:	Height: 150 mm Width: 499 mm Depth: 385 mm
Weight:	app. 20 kg
Temperature range:	-15°C to +55°C

RECEIVER CONTROLS R201

1. METER showing the received signal strength.

   With the RF-GAIN control in extreme clockwise position the meter deflection starts from 0.

   If the RF-GAIN control is turned counter clockwise, the pointer shows the signal level from where the automatical gain control (AGC) starts.

2. MODE. Switches between AM or SSB reception modes.

   NOTE: When TUNING MHz is placed at one of the emergency frequencies 500 KHz or 2182 KHz, the MODE swtich is out of function. The correct mode is chosen automatically in these positions.

4. DISPLAY. Displays the received frequency between 10 KHz and 30 MHz.

5. OUT OF RANGE INDICATION. If the TUNING KHz has exceeded its coverage range below xx,000,0 MHz or above xx,999,9 MHz, the out of range indication is turned on, and the display is flashing.

6. LOCK. If the lock push button is realeased, the variable frequency oscillator (TUNING KHz) is free running. If the lock push button is activated, the variable frequency oscillator will be locked to each 100 Hz as shown on the display.

   Fine tuning between the 100 Hz settings can be made with the CLARIFIER/ BFO.

7. HEADPHONES. Jack for connection of headphones.

8. LOUDSPEAKER. Switches on and off the loudspeaker.

9. RF-GAIN. The inner button of the double button controls the RF-sensitivity of the receiver.

10. AF-GAIN. The outer button of the double button controls the low frequency output power of the loudspeaker.

11. AGC. Switches the automatical gain control (AGC) between OFF, FAST decay, and SLOW decay. With the button in position OFF, the RF-GAIN control is used as manual sensitivity control.

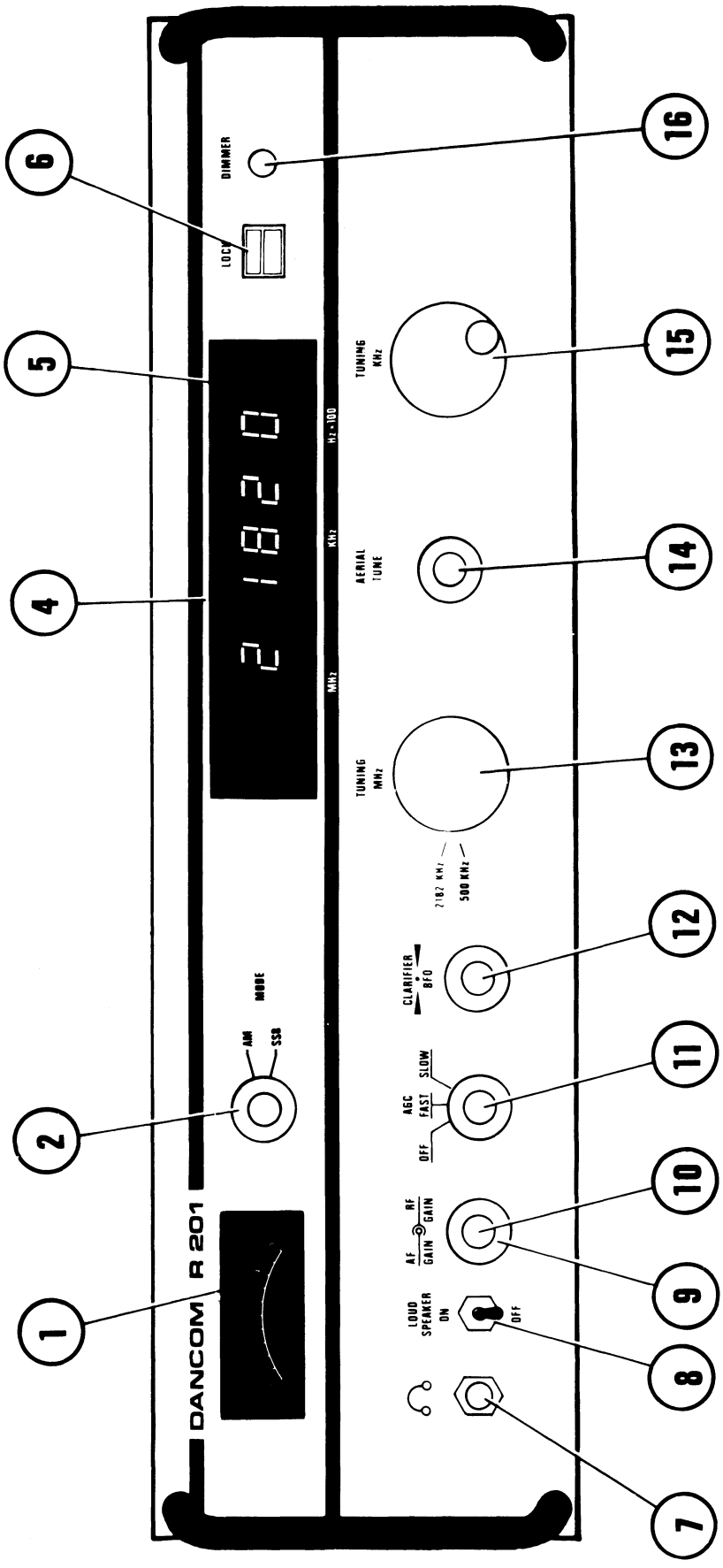
12. CLARIFIER. Fine tuning on SSB. Set to optimum voice quality. Variation range $\pm$ 250 Hz.

13. TUNING MHz. Coarse tuning in 1 MHz bands. The frequency setting is shown on the display.

14. AERIAL TUNE. Tunes the aerial tuned circuits to maximum sensitivity. Tune to maximum signal strength on the meter or to maximum output level from the loudspeaker.

15. TUNING KHz. Variable tuning covering 1 MHz. Tunes the frequency between the fixed 1 MHz bands which are tuned with TUNING MHz. The frequency setting (tuning of TUNING KHz) is shown on the display.

16. DIMMER. Controls the light intensity in the display and in the meter dial light.


DANCOM R 201
DIMMER
LOCK
TUNING KHz
Hz · 100
KHz
AERIAL TUNE
MHz
TUNING MHz
2182 KHz
500 KHz
CLARIFIER BFO
MODE
AM
SSB
AGC
SLOW
FAST
OFF
AF GAIN
RF GAIN
LOUD SPEAKER
ON
OFF
1
2
4
5
6
7
8
9
10
11
12
13
14
15
16

RECEIVER CONTROLS R203

1. METER showing the received signal strength.

   With the RF-GAIN control in extreme clockwise position the meter deflection starts from 0.

   If the RF-GAIN control is turned counter clockwise, the pointer shows the signal level from where the automatical gain control (AGC) starts.

2. MODE. Switches between AM, SSB, CW, and Fl reception modes.

3. BANDWIDTH. Switches between Wide 8 KHz, Intermediate 3 KHz, Narrow 1 KHz, and Very Narrow 200 Hz.

   The bandwidth switch does not function when the mode switch is in position SSB. Then the correct filter, which belongs to the SSB-mode, is chosen automatically.

   NOTE: When TUNING MHz is placed at one of the emergency frequencies 500 KHz or 2182 KHz both the MODE switch and the BANDWIDTH switch are out of function. The correct mode and bandwidth are chosen automatically in these positions.

4. DISPLAY. Displays the received frequency between 10 KHz and 30 MHz.

5. OUT OF RANGE INDICATION. If the TUNING KHz has exceeded its coverage range below xx,000,0 MHz or above xx,999,9 MHz, the out of range indication is turned on and the display is flashing.

6. LOCK. If the lock push button is released, the variable frequency oscillator (TUNING KHz) is free running. If the lock push button is activated, the variable frequency oscillator will be locked to each 100 Hz as shown on the display.

   Fine tuning between the 100 Hz settings can be made with the CLARIFIER/ BFO.

7. HEADPHONES. Jack for connection of headphones.

8. LOUDSPEAKER. Switches on and off the loudspeaker.

9. RF-GAIN. The inner button of the double button controls the RF-sensitivity of the receiver.

10. AF-GAIN. The outer button of the double button controls the low frequency output power of the loudspeaker.

11. AGC. Switches the automatical gain control (AGC) between OFF, FAST decay, and SLOW decay. With the button in position OFF, the RF-GAIN control is used as manual sensitivity control.

12. **CLARIFIER/BFO.** Single button with double function.

    With the MODE switch in position SSB, the button functions as CLARIFIER. Set to optimum voice quality.
    Variation range ± 250 Hz.

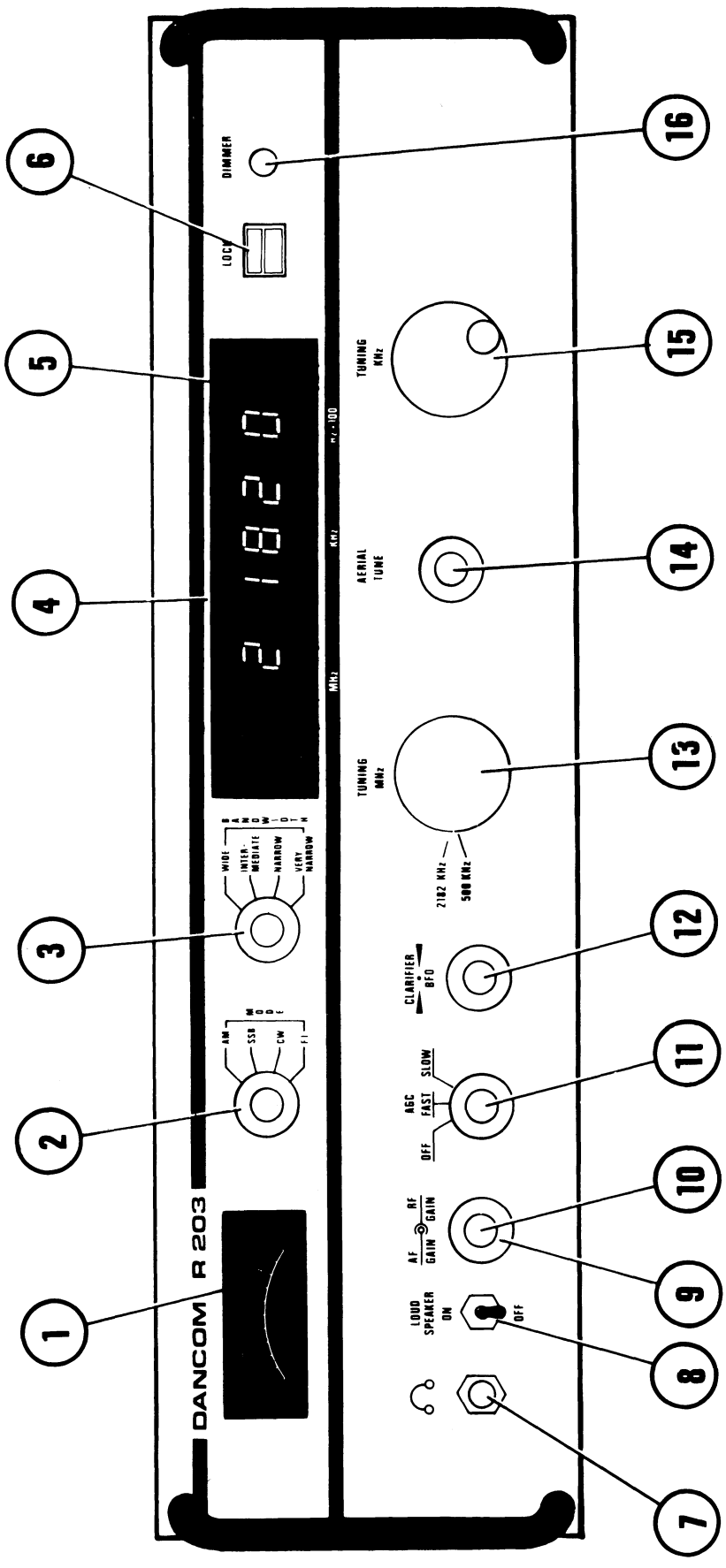
    With the MODE switch in position CW, the button functions as BFO. Set to requested beat-tone in the loudspeaker.
    Variation range ± 3 KHz.

13. **TUNING MHz.** Coarse tuning in 1 MHz bands. The frequency setting is shown on the display.

14. **AERIAL TUNE.** Tunes the aerial tuned circuits to maximum sensitivity. Tune to maximum signal strength on the meter or to maximum output level from the loudspeaker.

15. **TUNING KHz.** Variable tuning covering 1 MHz. Tunes the frequency between the fixed 1 MHz bands which are tuned with TUNING MHz. The frequency setting (tuning of TUNING KHz) is shown on the display.

16. **DIMMER.** Controls the light intensity in the display and in the meter dial light.


DANCOM R 203
DIMMER
LOCK
TUNING KHz
AERIAL TUNE
TUNING MHz
2182 KHz
500 KHz
CLARIFIER B.F.O
AGC
FAST
SLOW
OFF
RF GAIN
AF GAIN
LOUD SPEAKER
ON
OFF
MODE
AM
SSB
CW
FI
BANDWIDTH
WIDE
INTER-MEDIATE
NARROW
VERY NARROW
MHz
KHz
2 1 8 2 0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

INSTALLATION

GENERAL

In order to provide effective results, the radiotelephone and antenna system must be installed properly. The paragraphs below outline the requirements for proper installation.

Observe the precautions and suggestions in the paragraphs to ensure that your installation will provide troublefree and efficient operation.

LOCATION

The equipment should be located on the bridge, in the chartroom or other suitable place where it is ready accessible and reasonably protected from spray. The antenna should be located as high as practicable and in an area which is relatively free from obstructions.

A typical marine installation is shown on next page. Although installation will vary somewhat from ship to ship, the principles are common and the following suggestions will aid in making an efficient installation.

Mount the set on a table or shelf or alternatively it can be mounted directly on a bulkhead.

Keep a free air space behind and under the cabinet to allow air circulation through the cabinet. At least 15 mm free space.

Use the proper size of power conductor.

Keep the distance from the transmitter antenna terminal to the antenna feed-through as short as possible.

Avoid the use of coax-cable for the transmitter aerial.

Use a cupperband 50 to 100 mm wide for the earth connection and make it as short as possible.

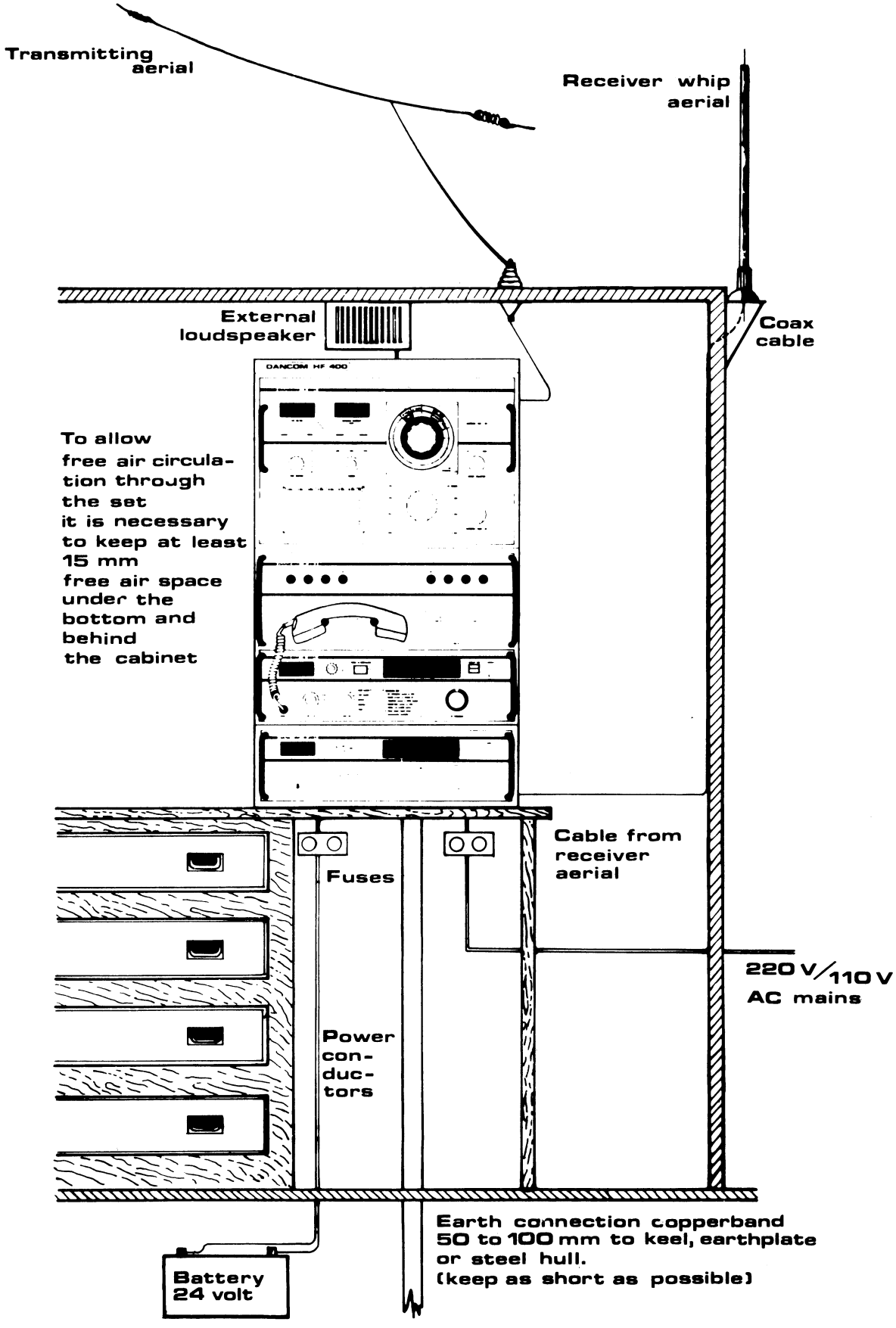
To guarantee best duplex results keep the distance between the transmitter and receiver aerial as great as possible.

MOUNTING

4 holes in the cabinet bottom and 8 in the rear allow it to be fitted to a table, a shelf or a bulkhead.

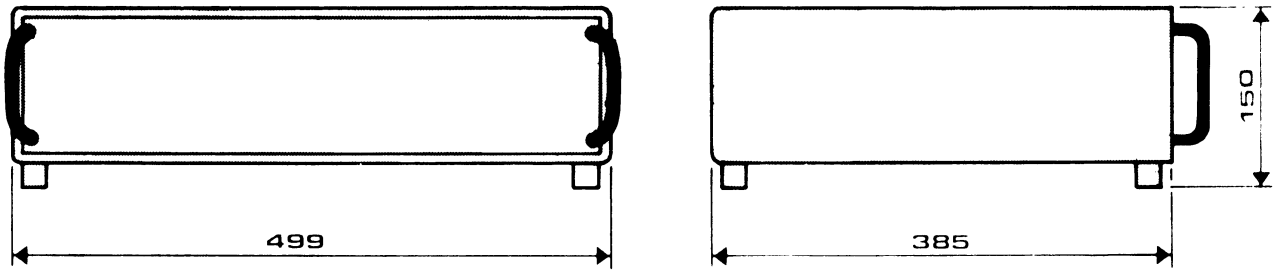
Use 6mm bolts or coach screws. These bolts or screws are not supplied, but use an adequate length according to the thickness of the material on which the equipment is to be mounted.

TYPICAL MARINE INSTALLATION



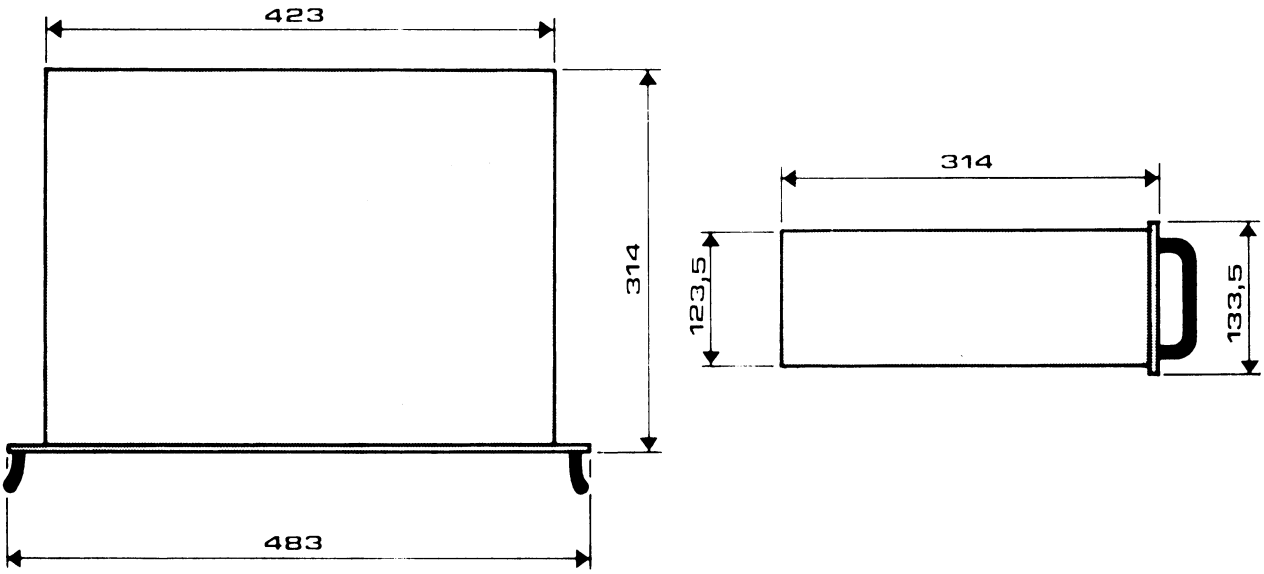
OVERALL DIMENSIONS

RECEIVER



TO ALLOW FREE AIR CIRCULATION THROUGH THE SET IT IS NECESSARY TO KEEP AT LEAST 15 M.M. FREE AIR SPACE UNDER THE BOTTOM AND BEHIND THE CABINET.

RACK-MOUNTING



ANTENNA

Any normal receiving antenna type can be employd. The antenna should be seperated as far as practicable from an eventual transmitting antenna. Use a coax. cable between the base of the antenna and the radio receiver with the screen connected to the equipment. Keep the coax. cable as short as possible.

RECEIVER SYSTEM

System Principle

Analogue Signal Path:-
- Aerial Protection
- Bands Unit
- H.F. Amplifier
- H.F. Converter
- I.F. Filters
- First I.F. Amplifier
- Second I.F. Amplifier & Detectors
- A.F. Amplifiers

Frequency Synthesizer:-
- TCXO
- TCXO Multiplier
- V.F.O.
- Distress Frequency Oscillator
- Summing Loop
- 1 MHz. Loop
- Clarifier Loop
- Carrier Reinsertion & B.F.O.
- Coder
- Counter & Display

Power Supplies

H.F.400 S.S.B. RADIO TELEPHONE

RECEIVER GENERAL DESCRIPTION

System Principle

The Dancom H.F.400 receiver is a synthesized system capable of being tuned continuously from 10 KHz. to 30 KHz. The unit is self contained in one rack. The receiver tuning has two preset positions for 500 KHz. and 2182 KHz. The power input can be 24 volts D.C. or 110/220 volts A.C.

The receiver comes in two variations, the R201 and the R203. The R203 has the extra mode positions to enable more efficient reception of telegraphy and telex signals.

The R201 and the R203 are completely interchangeable in the H.F.400 system and can be supplied in a separate cabinet if required.

The receiving system can be separated into the analogue signal path circuitry and the frequency synthesizer.

The input signal enters the receiver via an aerial protection circuit and then enters the bands unit. In the bands unit the signal is filtered by pre-selector tuned sets switched by the bands switch. From here the signal is passed into the first mixer.

The first mixer combines the incoming signal with a variable mixer frequency to give an output af 45.1 MHz. This passes through a crystal filter and onto the second mixer. The second mixer can be fed with one of two mixer frequencies. These are spaced 1.5 KHz. apart and give the effect of moving the mixer output relative to the I.F. amps so that the number of I.F. filters can be reduced.

From the second mixer the signal enters the appropriate I.F. filter at either 580 KHz. or 581.5 KHz. and then passes onto the first I.F. amplifier. The signal then passes through a second I.F. amplifier. The second I.F. amplifier gain can be adjusted by the R.F. gain control. Both I.F. amplifiers have A.G.C.

From the I.F. amplifiers the signal is then detected in either an S.S.B. or an A.M. detector. The A.F. is then passed onto an A.F. pre-amplifier and into either a balanced 600 ohms output transformer, or into an integrated circuit A.F. power amplifier to drive a loudspeaker.

To provide the correct mixer frequencies a frequency synthesizer is used. All the synthesizer frequencies are derived from a TCXO running at 10 MHz. This TCXO is identical to that used in the H.F.400 transmitter system.

The first local oscillator sweeps between 46.1 MHz and 75.1 MHz. and determines the receiving frequency. The frequency counter on the receiver front panel is measuring the variable frequency oscillator and displays the frequency the receiver is tuned to. A frequency lock circuit pulls the V.F.O. to the nearest 100 Hz.

The second mixer oscillator is delivered from the TCXO and can be offset by 1.5 KHz to achieve the correct I.F. filtering. It can also be fine tuned in the S.S.B. mode to provide clarifier operation of $\pm$ 250 Hz.

The carrier reinsertion oscillator is a separate crystal oscillator operating at 5.8 MHz. This is divided by ten to give 580 KHz. fed to the product detector.

The B.F.O. oscillator is a V.C.O. operating at 580 KHz. and uses the S.S.B. detector to obtain the beat-tone for C.W. working. The V.C.O. has a range of $\pm$3 KHz.

Analogue Signal Path

Aerial Protection

The aerial input is passed through an aerial protection network. This network limits any high voltages on the aerial to a safe level. A maximum of 30 volts pp is allowable on the aerial. A voltage dependent resistor limits the input current, and diodes clip the output to 1.2 volts pp.

Bands Unit

The MHz. multi-position frequency selector switch selects appropriate pre-selector tuned circuits. These are lowpass or bandpass filters and are tuned by the aerial tune knob on the front panel. This tune control must be used to track the local oscillator so as to obtain maximum sensitivity.

The frequency selector switch also operates a potential divider network to set up the course tune volts to the loop V.C.O.'s. The frequency selector switch also switches the B.C.D. lines to the coder. This is discussed under frequency synthesizer.

From the pre-selector filters the signal passes on to the H.F.

H.F. Amplifier

The signal enters the H.F. amplifier via conventional protection diode network. The amplifier is a dual gate MOSFET. The output of this amplifier is coupled into a lowpass filter to pass up to 30 MHz. Coupling transformer L 1 determines the low frequency characteristic.

The amplifier and filter combination is tested with 50 ohms source and 50 ohms termination.

From the H.F. amplifier the signal enters the H.F. converter.

H.F. Converter

The H.F. converter converts the input signal, which is in the range 0-30 MHz., to a fixed 45.1 MHz. The mixer is a balanced F.E.T. mixer which drives into a crystal filter.

The V.F.O. output, modified in the summing loop, is fed to the mixer in the range 45.1 MHz. to 75.1 MHz.

The bandpass crystal filter is centred on 45.1 MHz. and gives maximum rejection at the image frequency of 46.26 MHz.

After the crystal filter the signal enters the second mixer. This mixes the 45.1 MHz. signal down to about 580 KHz. The second mixer frequency is 45.68 MHz. or 45.6815 MHz. coming from the clarifier loop. The choice of two mixer frequencies enables the I.F. signal to be moved 1.5 KHz with reference to the I.F. filters. Thus moving the frequency effectively alters the I.F. frequency characteristic.

In A.3.J. the second mixer output is 580 KHz. $\pm$ 200 Hz. The small change comes from the effect of the clarifier control on the clarifier loop.

In other modes the output is 581.5 KHz.

From the second mixer the resultant signal enters the I.F. Filters.

I.F. Filters

I.F. Filters

The signal enters the I.F. filters from the H.F. converter at either 580 KHz. or 581.5 KHz. There are four filters in the R203 and two filters in R201. The appropriate filter is switched at the input and output ports by diodes. Thus only one filter is ever operative.

The S.S.B. filter is centred on 581.5 KHz. Thus the input signal is 580 KHz. in the S.S.B. position and the filter passes the U.S.B. In all other modes the input frequency is 581.5 KHz. This enables the S.S.B. filter to be used for A.3.J. or as an intermediate filter in other modes.

In the R203 the S.S.B. filter is automatically selected in S.S.B. modes and the filter selection control is inoperative. In other modes the appropriate filter has to be selected.

In the R201 the filter circuits are all automatically selected appropriate to the receive mode selected.

The choice of bandwidths on the R203 is 8 KHz., 2.7 KHz., 1 KHz. and 200 Hz.

The automatic selection on the R201 is 6 KHz. for A.M. and 2.7 KHz. for S.S.B., CW, Fl.

The signal passes through the selected filter and onto the first I.F. amplifier.

First I.F. Amplifier

The signal enters the first I.F. amplifier from the filter bands. This is a single transistor gain controlled stage. The output passes through another bandpass filter centred on 581.5 MHz. and onto the second I.F. amplifier.

The output from the bandpass filter is sampled, amplified and detected and then operates an A.G.C. amplifier. This in turn operates an F.E.T. which shunts the negative feedback in the first I.F. amplifier. Thus A.G.C. action around this single stage is achieved.

Second I.F. Amplifier and Detectors

The signal from the bandpass filter following the first I.F. amplifier enters a second I.F. amplifier consisting of three tuned stages centred on 581.5 KHz. The first two stages are gain controlled and the third stage is only used for the A.M. detector.

The second I.F. stage feeds the S.S.B. product detected which is fed with a stable 580 KHz. derived from a crystal oscillator. The output from this detector enters a gated audio pre-amplifier which is enabled when the S.S.B., Cw or Fl mode is selected.

The third I.F. stage feeds a conventional diode detector which is used for the A.G.C. and A.M. detection. The detected A.M. is fed to a gated pre-amplifier which is enable in A.M. mode only.

The A.G.C. voltage is fed to an A.G.C. amplifier and is then switched such that the I.F. stage gain is controlled either by the A.G.C. amplifier or the manual R.F. gain control. A transistor switch alters the A.G.C. attack time by switching a capacitor in or out of circuit.

A.F. Amplifiers

The A.F. comes from the appropriate detector through the enabled pre-amplifier and onto the A.F. gain control potentiometer. Two lines come off the potentio-

A.F. Amplifiers

meter. One is full output to the 600 ohms line driver and the other is controlled and given to the integrated circuit loudspeaker amplifier.

The loudspeaker output power is approximately 3W into 4 ohms.

The balanced 600 ohms line output power is 10 mV.

oooOOOooo

Frequency Synthesizer

TCXO

The temperature controlled crystal oscillator is the heart of the synthesizer. The crystal temperature drift is compensated for by a combination of trimming capacitors of suitable temperature coefficient. Over the range 0-60^{o} c the drift is less than three parts per million. This sets the temperature stability of the system.

The oscillator is factory set and cannot be reset without equipment that is not normally available in a service workshop. The TCXO is plugable and, therefore, is easily replaced. It is identical to the transmitter TCXO.

TCXO Multiplier

The TCXO Multiplier use the 10 MHz. TCXO signal and splits it two ways. The signal is then outputed to the frequency counter and the 1 MHz. loop.

The 10 MHz. signal is also routed through a harmonic multiplier where the fifth harmonic is used to give 50 MHz. out to the clarifier loop.

V.F.O.

The variable frequency oscillator controls the variable tuning of the receiver. The V.F.O. control is a variable inductance in the gate circuit of an F.E.T. oscillator. This oscillator is capable of being locked on frequency by a control voltage obtained from a "pull in" circuit situated on the counter and display circuit. With the lock circuit engaged the receiver stabilizes at 100 Hz. intervals. The "pull in" circuit has a long time constant.

The V.F.O. can be set to oscillate between 2.1 MHz. and 3.1 MHz. thus fulfilling the requirement of a continuously variable range of 1 MHz.

The V.F.O. supply can be switched off by gating the supply buffer. This enables the distress oscillator to set the receive frequency.

The V.F.O. output is buffered and passes onto the distress oscillator board.

Distress Frequency Oscillator

The V.F.O. output is fed onto the D.F.O. board to be switched with the distress oscillator output. Switching diodes ensure that the output from the board is only one of these two sources.

The D.F.O. oscillator is a transistor with two circuits in its base. These are diode gated such that either the 2600 KHz. or the 2282 KHz. crystal is operative. These crystal circuits can be pulled from the "pull in" circuit so as to keep them on frequency.

Distress Frequency Oscillator

The output of the D.F.O. board is, therefore, 2600 KHz., 2282 KHz. or variable 2.1 - 3.1 KHz. These set the receiver frequency to 500 KHz., 2182 KHz. or 0-1 MHz. variable. The latter is later combined with 1 MHz. discreet steps to give 0-30 MHz. variable.

These outputs appropriately gated and buffered pass onto the counter and also the summing loop.

Summing Loop

One of the outputs from the D.F.O. is fed to the summing loop. This is a signal in the frequency range 2.1 MHz. - 3.1 MHz. and is used to "fine tune" the first mixer frequency.

The summing loop is a phase locked mixer loop. The P.S.D. operates at the V.F.O./ D.F.O. frequency and drives the V.C.O. to operate in the range 45.1 to 75.1 MHz. This output is buffered out to the first mixer.

The V.C.O. output is fed back via a mixer to the phase sensitive detector. An input from the 1 MHz. loop in the range 43 MHz. - 72 MHz. is mixed with the output 45.1 MHz. - 75.1 MHz. to produce the 2.1 MHz. - 3.1 MHz. that operates the P.S.D.

Thus the output of the summing loop to the first mixer steps at 1 MHz. with 0-1 MHz. variable tuning so defining the receiver operating frequency range.

To enable the V.C.O. to operate over a wide range and yet keep the loop sensitive, course tuning volts are fed to the V.C.O. from the bands switch.

1 MHz. Loop

This loop provides the 1 MHz. steps between 43 MHz. - 72 MHz. to drive the summing loop mixer. It is very similar to the 1 MHz. loop in the transmitter and operates at similar frequencies.

An input from the TCXO, via the multiplier, is divided down to 500 KHz. and operates the P.S.D.

The error output from the P.S.D. drives the V.C.O. at stepped frequencies between 43-72 MHz. The output of the V.C.O. is divided by two, enters a programmable divider, and is applied to the P.S.D. at 500 KHz.

The programmable divider operates ratios between 43 and 72. The instruction comes from the coder.

The P.S.D. operates at 500 KHz but because of the - 2 in the feedback loop the V.C.O. output steps at 1 MHz.

To enable the V.C.O. to operate over a wide range, and so keep the loop sensitive, course tuning volts are fed to the V.C.O. from the bands switch.

Clarifier Loop

The clarifier loop is of a similar configuration to the summing loop, that is a phase locked mixer loop.

The P.S.D. operates at the crystal oscillator frequency of 4318.5 KHz. or 4320 KHz. The 4320 KHz. can be pulled $\pm$ 100 Hz. by the clarifier control. The 4318.5 KHz. oscillator is used in all modes except A.3.J. so as to place the I.F. signal in the centre of the I.F. filters.

Clarifier Loop

The P.S.D. error signal drives a TCXO operating at approximately 2284.040 KHz. The second harmonic output from this is buffered and taken to the second mixer. The output frequencies are 45.680 MHz ± 200 Hz. or 54.6815 MHz.

This output is also fed back to the loop mixer, mixed with 50 MHz., and fed back into the phase detector. The 50 MHz. signal is derived from the TCXO multiplier.

Carrier Reinsertion & B.F.O.

When the S.S.B. detector is in use for A.3.J. working, the 580 KHz. carrier reinsertion frequency is derived from a stable fixed frequency crystal oscillator. This oscillator runs at 5.8 MHz. and is fed to a decade divider. The divider output is diode gated into a 580 KHz. amplifier and then onto the product detector, situated on the second I.F. board.

When the S.S.B. detector is used for C.W. working, a frequency of about 581.5 KHz. is derived from a variable frequency oscillator. The exact output frequency can be varied by ± 3 KHz by the B.F.O. front panel control. Varicap diodes are used to vary the oscillator frequency. The oscillator output is diode gated into the 580 KHz. amplifier and then is fed onto the product detector situated on the second I.F. board.

Coder

The coder encodes front panel MHz. information into a suitable form for operating the display and dividers. The information is taken off the two multipole switch wafers and converted into binary by a matrix. The information is coded differently for the display than the divider. A truth table gives the output.

A third wafer is used to operate a resistor network to give course tuning to the V.C.O.'s.

Counter & Display

The display shows the frequency that the receiver is tuned to. The MHz. information comes from the front panel switch and the remaining information is counted off the V.F.O. output.

The MHz. information operates directly on the display drivers. The KHz. and Hz. information is counted off the 2.1 - 3.1 MHz. V.F.O. output, the count is stored and the store operates the display driver. The counter is reset to 900 KHz. to compensate for the 100 Hz. offset in V.F.O. frequency. An out of range indication is given by the 100 KHz. counter output. This senses when the count is below 2.1 MHz. or above 3.1 MHz. The out of range signal operates a gated multivibrator, which in turn operates on the display driver zero blanking circuit, causing the display to flash.

The counter counts down to 10 Hz. but only 100 Hz. are displayed. The 10 Hz. count is used to operate the frequency lock circuit. This 10 Hz. output number is compared with decimal 5 in B.C.D. and the difference operates the pull in circuit. Thus the V.F.O. or D.F.O. is pulled to 50 Hz. above the displayed frequency. This prevents the display's last figure from alternating. The integrator uses the error signal to slowly pull the V.F.O./D.F.O. frequency.

The TCXO input frequency is divided down to operate the counting system. From these dividers the input gate, reset, etc. pulses are derived.

The display incorporates zero blanking so that no zeroes appear before a num-

Counter & Display

ber.

A dimmer circuit dims the L.E.D. display.

ooo000ooo

Power Supplies

The receiver is completely self-contained as regards power supplies. It can be run from 110/220 A.C. or 24 V D.C. The power source is selected on the P103 front panel. The principle of the receiver power supply system is very similar to the exiter power supply system.

A D.C. converter working in push pull mode converts 24v. D.C. into an A.C. waveform fed to the primary of a common transformer. Another primary winding takes the 110V/220V A.C. input.

The selected input drives the transformer to obtain +35 V, +15 V, +15 V, +5 V from regulators on the transformer secondaries.

The 15 V, 15 V and 5 V regulators are integrated circuits, and the 35 V regulator is made of discreet components.

The power supply chassis also holds the A.F. speaker amplifier and line driver amplifier. These are discussed under "Analogue Signal Paths".

ooo000ooo

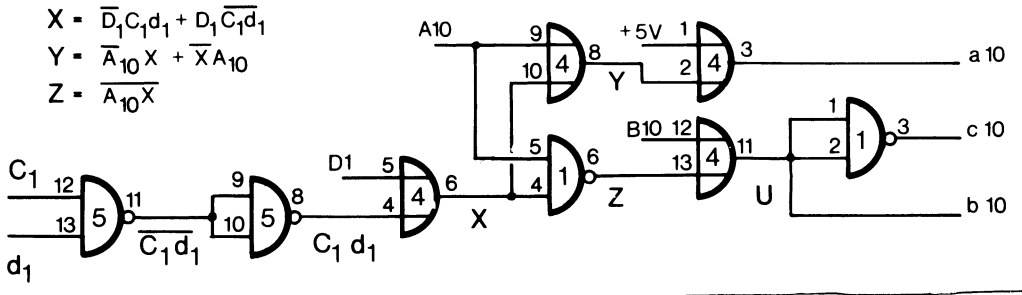
RECIEVER CODER TRUTH TABLE

BAND MHz	Display TEN'S $D_{10}C_{10}B_{10}A_{10}$	Display ONE'S $d_1\ c_1\ b_1\ a_1$	$\overline{C_1}$ $\overline{d_1}$	C_1 d_1	X	Y	Z	U	$\frac{1}{M}$	Devider TEN'S $D_{10}C_{10}B_{10}A_{10}$	Devider ONE'S $d_1\ c_1\ b_1\ a_1$	
500 Khz	0 0 0 0	0 0 0 0	1	0	0	0	1	1	43	0 1 0 1	0 1 1 0	56
2182 Khz	0 0 0 0	0 0 1 0	1	0	0	0	1	1	45	0 1 0 1	0 1 0 0	54
0	0 0 0 0	0 0 0 0	1	0	0	0	1	1	43	0 1 0 1	0 1 1 0	56
1	0 0 0 0	0 0 0 1	1	0	0	0	1	1	44	0 1 0 1	0 1 0 1	55
2	0 0 0 0	0 0 0 1	1	0	0	0	1	1	45	0 1 0 1	0 1 0 0	54
3	0 0 0 0	0 0 1 1	1	0	0	0	1	1	46	0 1 0 1	0 0 1 1	53
4	0 0 0 0	0 1 0 0	1	0	0	0	1	1	47	0 1 0 1	0 0 1 0	52
5	0 0 0 0	0 1 0 1	1	0	0	0	1	1	48	0 1 0 1	0 0 0 1	51
6	0 0 0 0	0 1 1 0	1	0	0	0	1	1	49	0 1 0 1	0 0 0 0	50
7	0 0 0 0	0 1 1 1	0	1	1	1	1	1	50	0 1 0 0	1 0 0 1	49
8	0 0 0 0	1 0 0 0	1	0	1	1	1	1	51	0 1 0 0	1 0 0 0	48
9	0 0 0 0	1 0 0 1	1	0	1	1	1	1	52	0 1 0 0	0 1 1 1	47
10	0 0 0 1	0 0 0 0	1	0	0	1	1	1	53	0 1 0 0	0 1 1 0	46
11	0 0 0 1	0 0 0 1	1	0	0	1	1	1	54	0 1 0 0	0 1 0 1	45
12	0 0 0 1	0 0 1 0	1	0	0	1	1	1	55	0 1 0 0	0 1 0 0	44
13	0 0 0 1	0 0 1 1	1	0	0	1	1	1	56	0 1 0 0	0 0 1 1	43
14	0 0 0 1	0 1 0 0	1	0	0	1	1	1	57	0 1 0 0	0 0 1 0	42
15	0 0 0 1	0 1 0 1	1	0	0	1	1	1	58	0 1 0 0	0 0 0 1	41
16	0 0 0 1	0 1 1 0	1	0	0	1	1	1	59	0 1 0 0	0 0 0 0	40
17	0 0 0 1	0 1 1 1	0	1	1	0	0	0	60	0 0 1 1	1 0 0 1	39
18	0 0 0 1	1 0 0 0	1	0	1	0	0	0	61	0 0 1 1	1 0 0 0	38
19	0 0 0 1	1 0 0 1	1	0	1	0	0	0	62	0 0 1 1	0 1 1 1	37
20	0 0 1 0	0 0 0 0	1	0	0	0	1	0	63	0 0 1 1	0 1 1 0	36
21	0 0 1 0	0 0 0 1	1	0	0	0	1	0	64	0 0 1 1	0 1 0 1	35
22	0 0 1 0	0 0 1 0	1	0	0	0	1	0	65	0 0 1 1	0 1 0 0	34
23	0 0 1 0	0 0 1 1	1	0	0	0	1	0	66	0 0 1 1	0 0 1 1	33
24	0 0 1 0	0 1 0 0	1	0	0	0	1	0	67	0 0 1 1	0 0 1 0	32
25	0 0 1 0	0 1 0 1	1	0	0	0	1	0	68	0 0 1 1	0 0 0 1	31
26	0 0 1 0	0 1 1 0	1	0	0	0	1	0	69	0 0 1 1	0 0 0 0	30
27	0 0 1 0	0 1 1 1	0	1	1	1	1	0	70	0 0 1 0	1 0 0 1	29
28	0 0 1 0	1 0 0 0	1	0	1	1	1	0	71	0 0 1 0	1 0 0 0	28
29	0 0 1 0	1 0 0 1	1	0	1	1	1	0	72	0 0 1 0	0 1 1 1	27

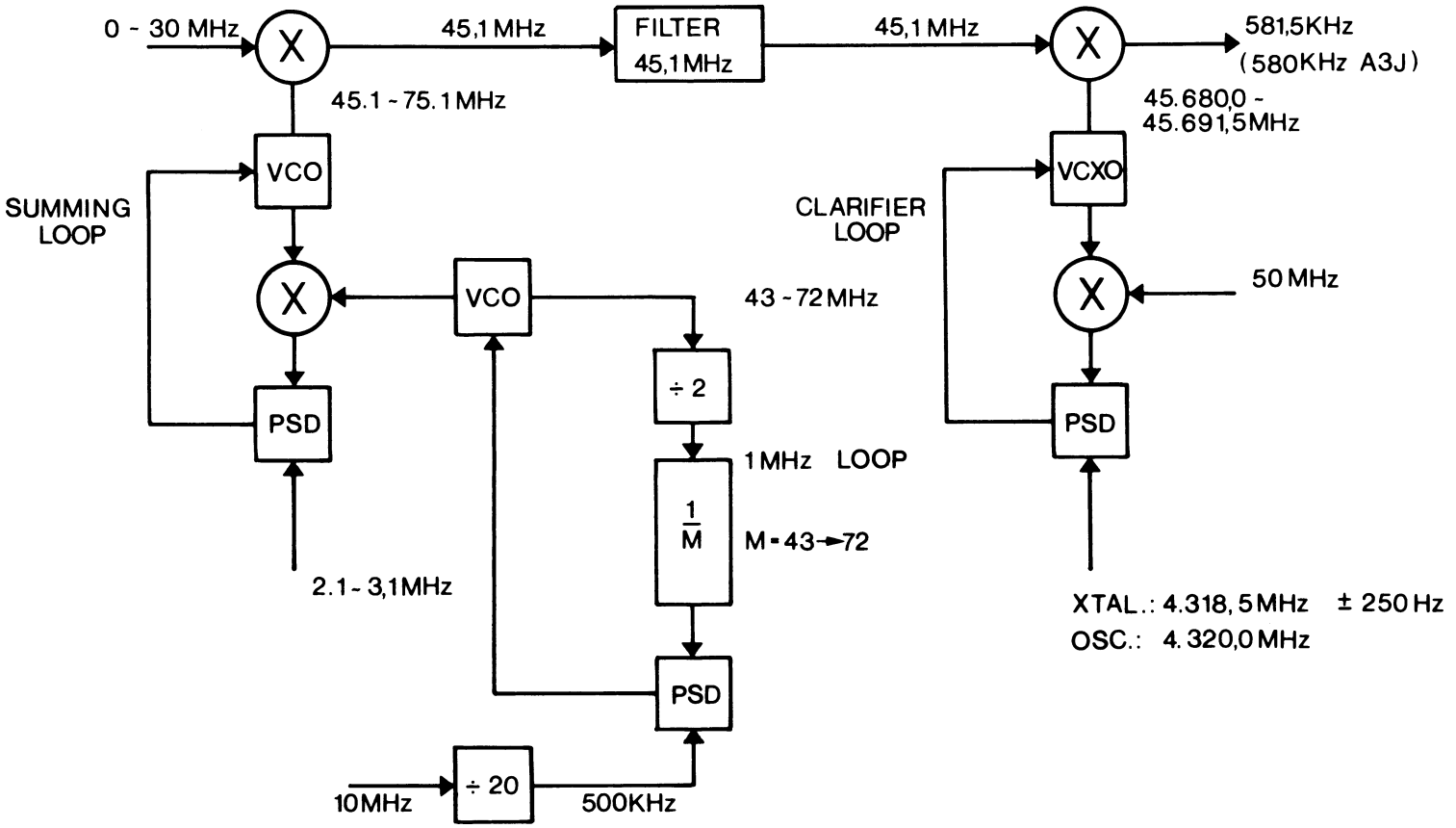
$X = \overline{D_1}C_1d_1 + D_1\overline{C_1}\overline{d_1}$

$Y = \overline{A_{10}}X + \overline{X}A_{10}$

$Z = \overline{A_{10}X}$



RECEIVER SYNTHESIZER LOOPS.

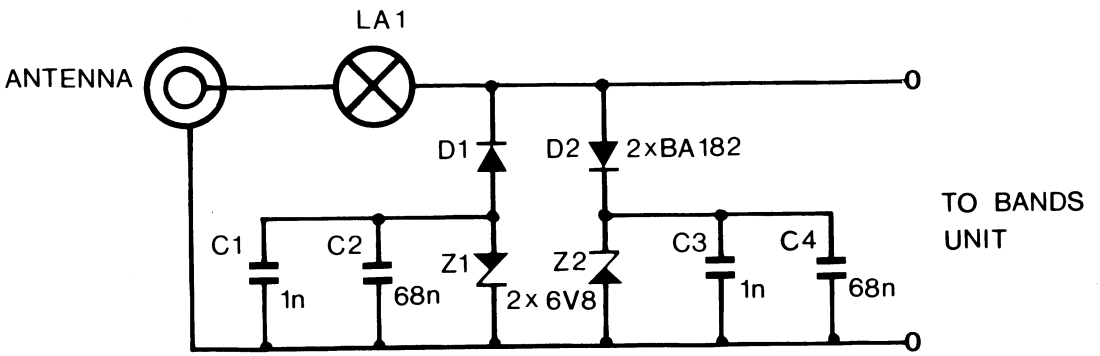


C I R C U I T D I A G R A M S.

FOR:

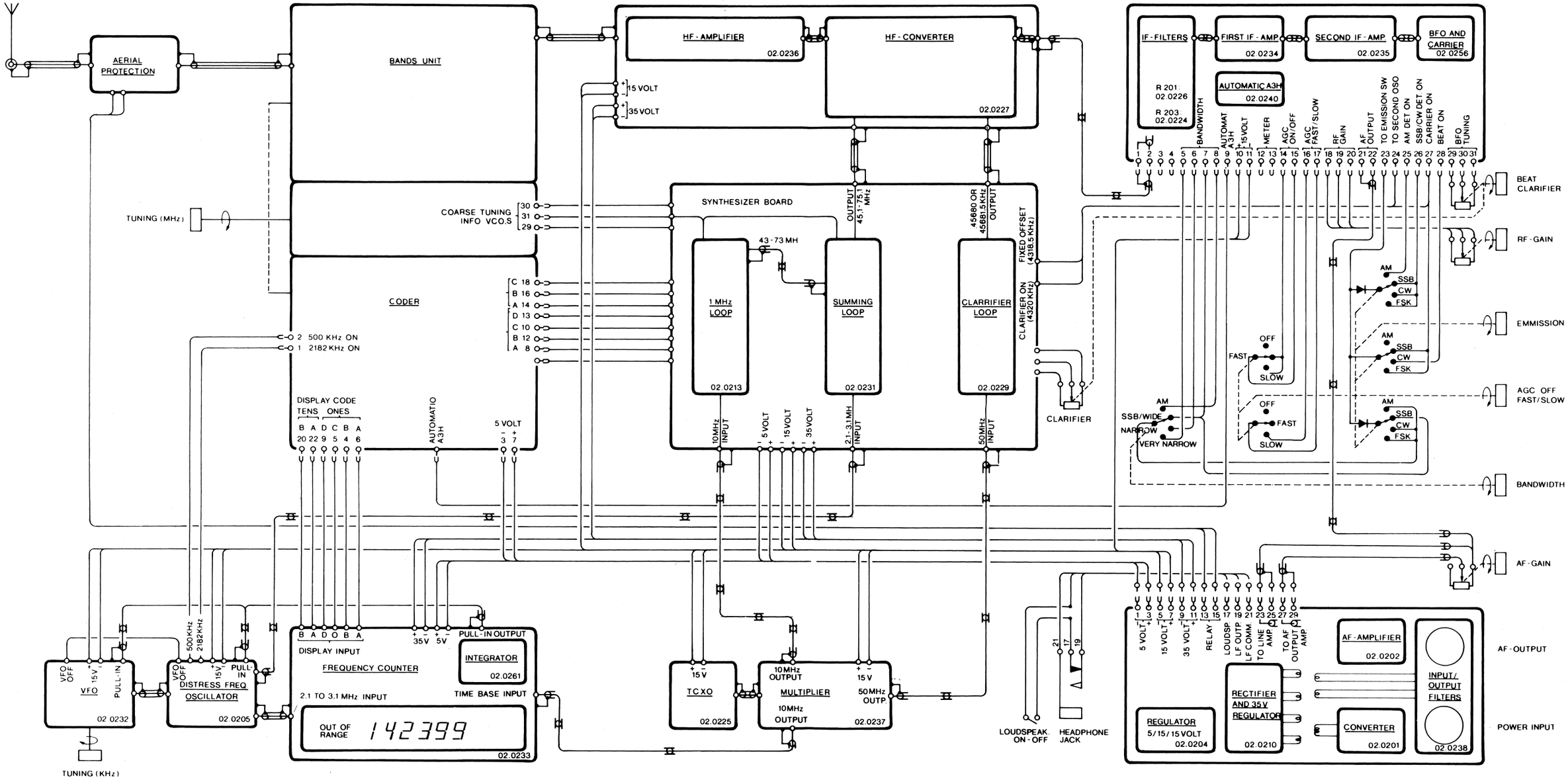
RECEIVER R 201.

CONTENTS:



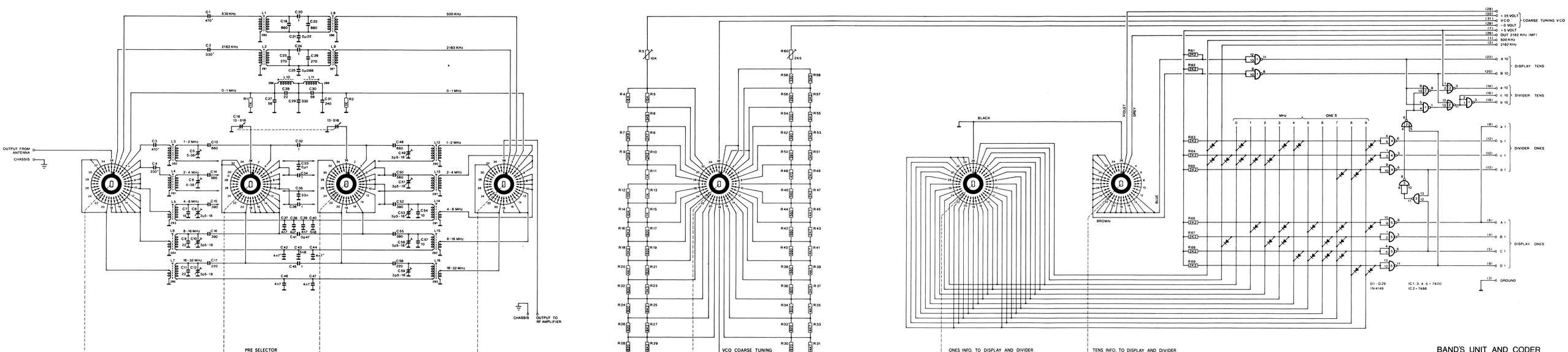
AERIAL PROTECTION MODULE 239

01.0242

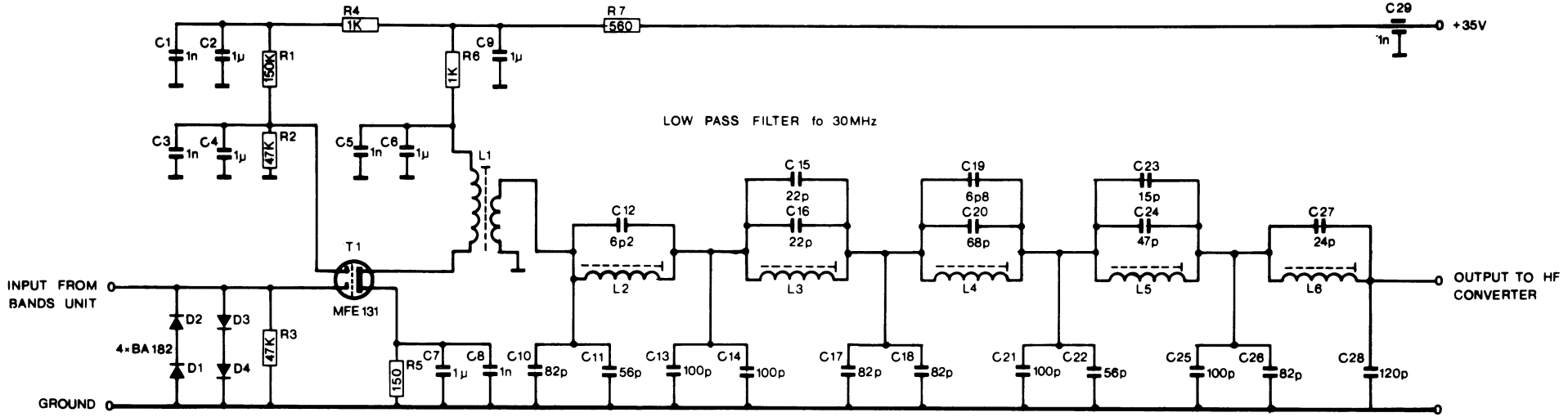


WIRING DIAGRAM

FOR RECEIVERS R 201-203



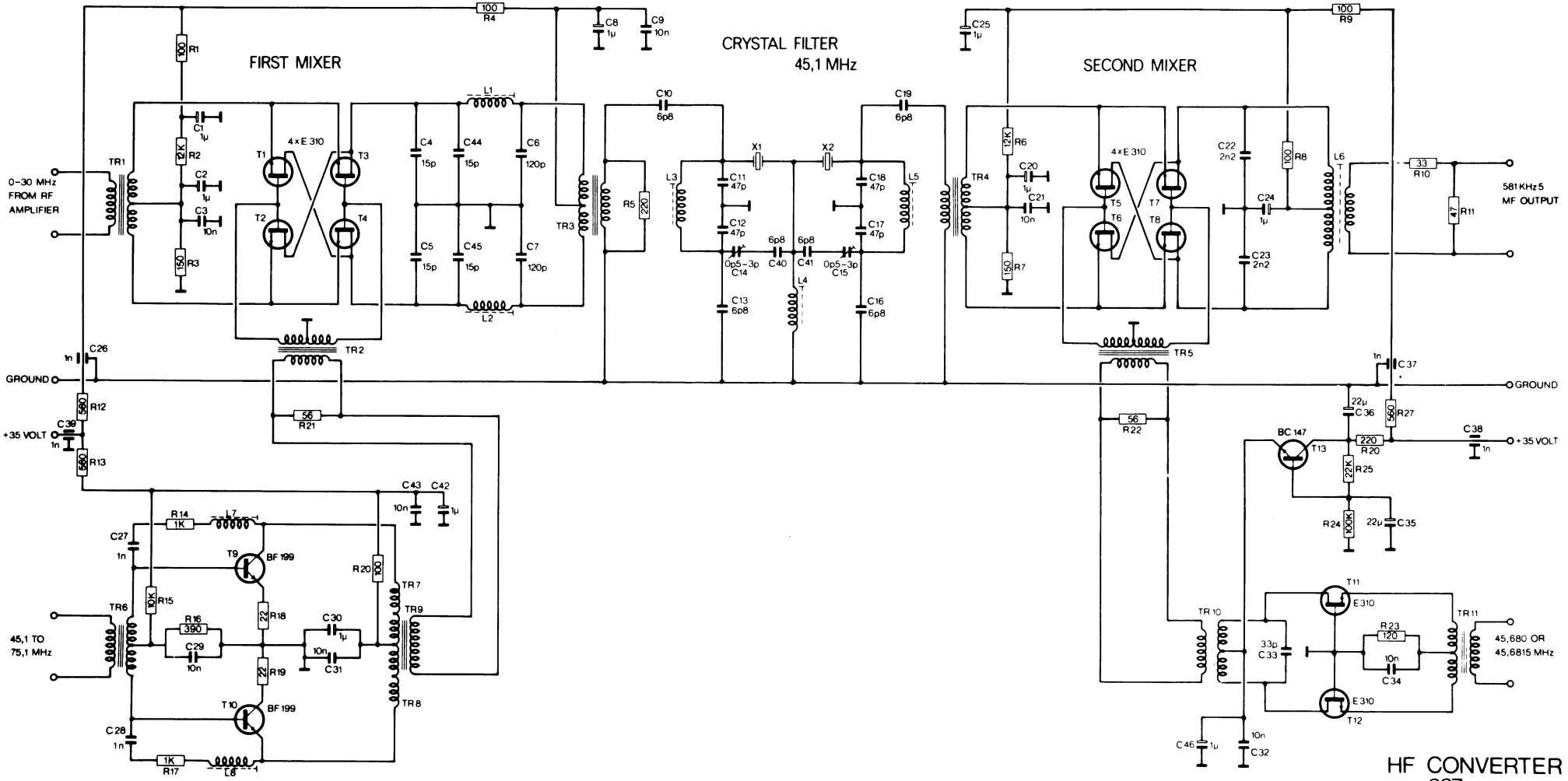
BAND'S UNIT AND CODER
UNIT NO. 02.0228
DRAWING NO. 01.0243

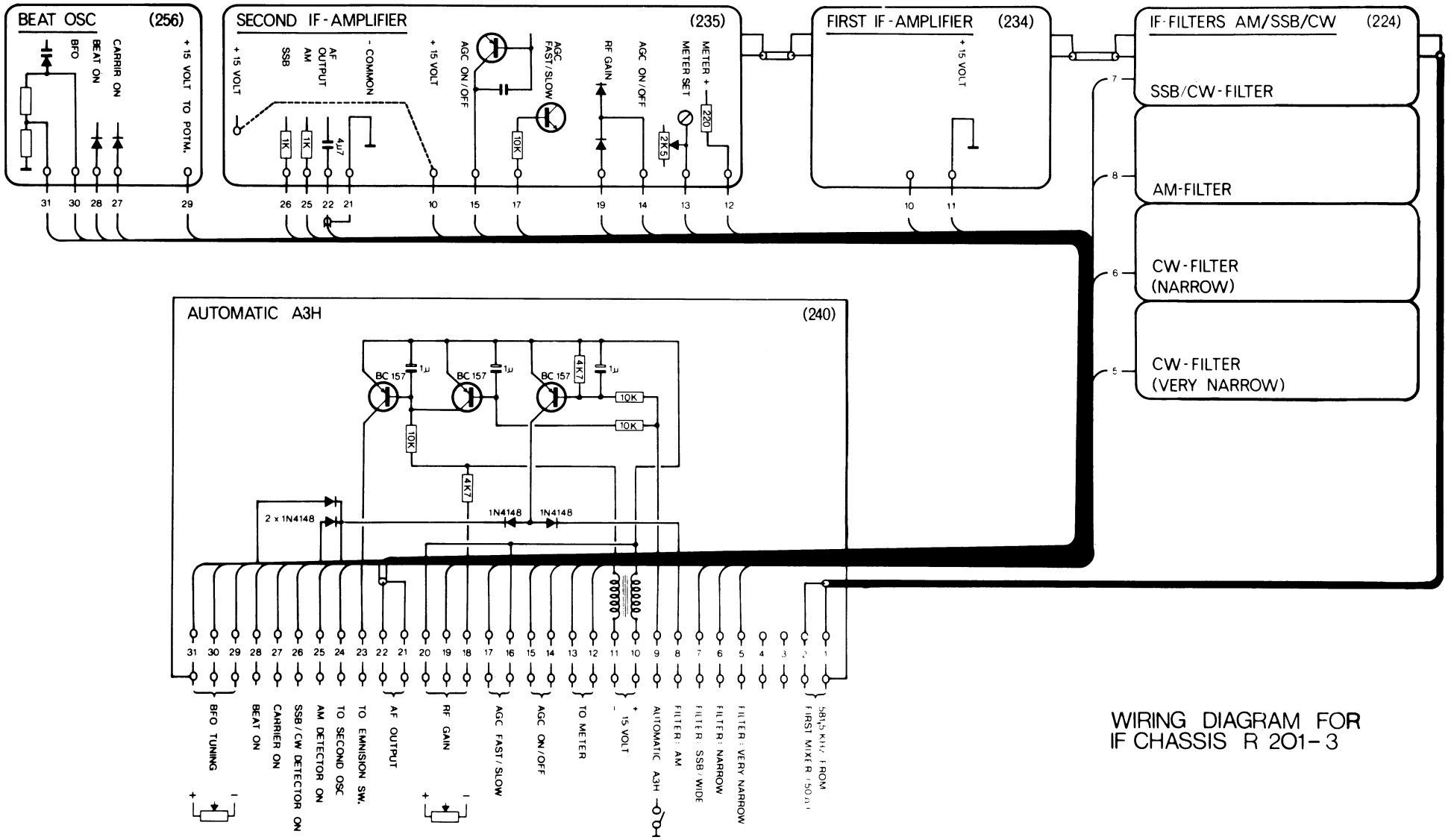


HF AMPLIFIER

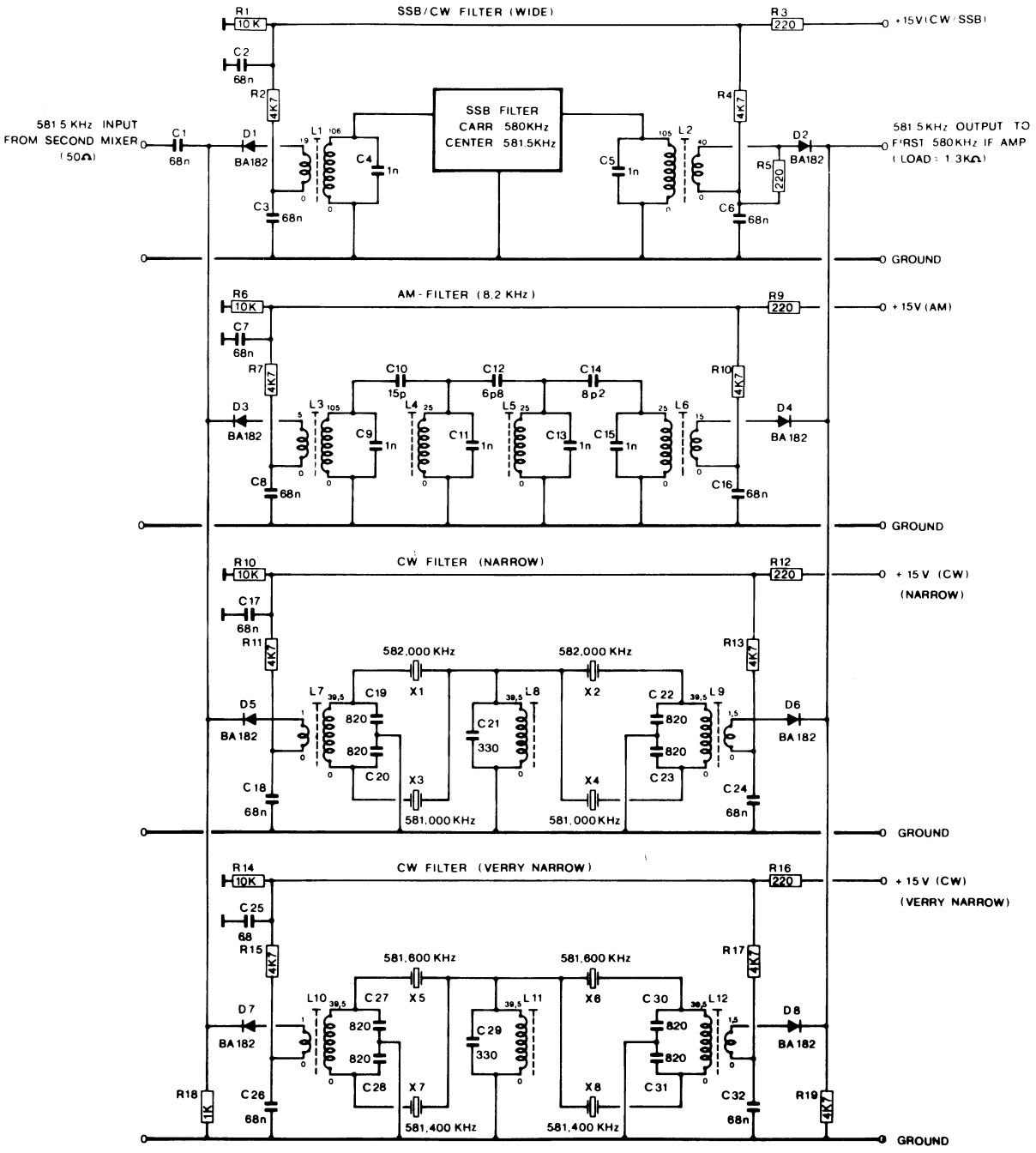
MODULE 02.0236

01.0244


FIRST MIXER
CRYSTAL FILTER
45,1 MHz
SECOND MIXER
0-30 MHz
FROM RF
AMPLIFIER
4 x E 310
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
BF 199
E 310
BC 147
X1
X2
L1
L2
L3
L4
L5
L6
L7
L8
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R27
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
C36
C37
C38
C39
C42
C43
C44
C45
C46
GROUND
+35 VOLT
45,1 TO
75,1 MHz
581 KHz 5
MF OUTPUT
45,680 OR
45,6815 MHz
HF CONVERTER
227

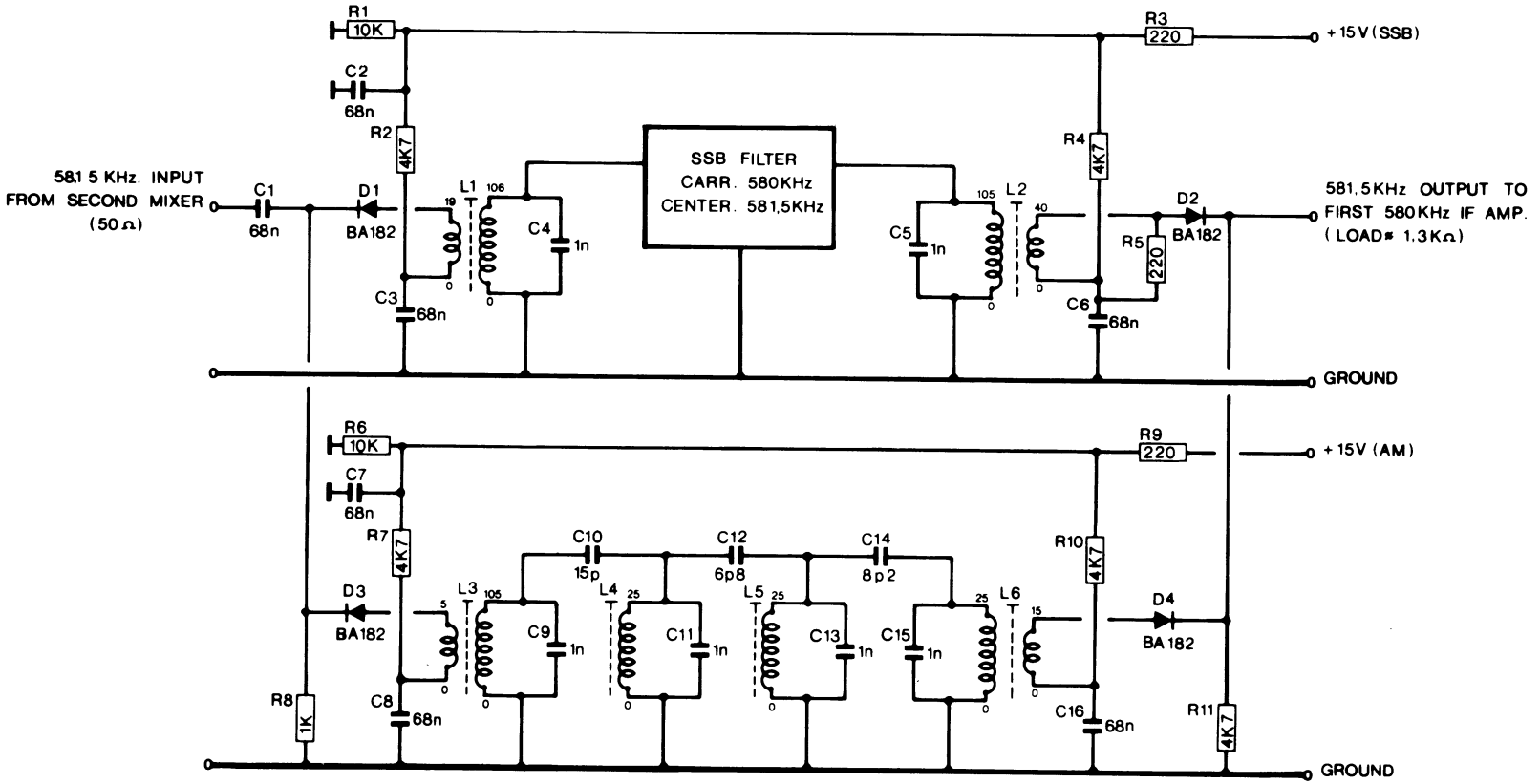


WIRING DIAGRAM FOR
IF CHASSIS R 201-3

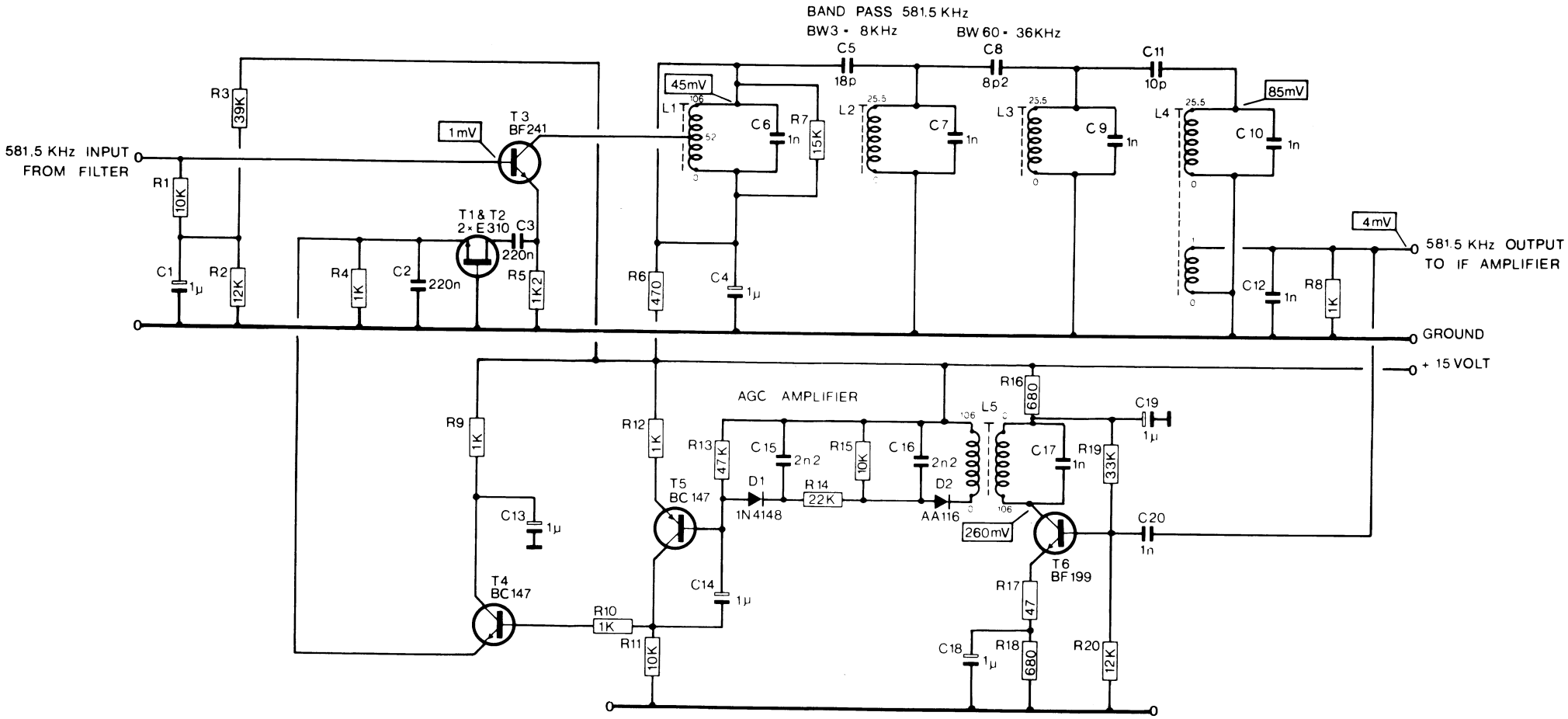


IF FILTERS AM/SSB/CW

01.0249

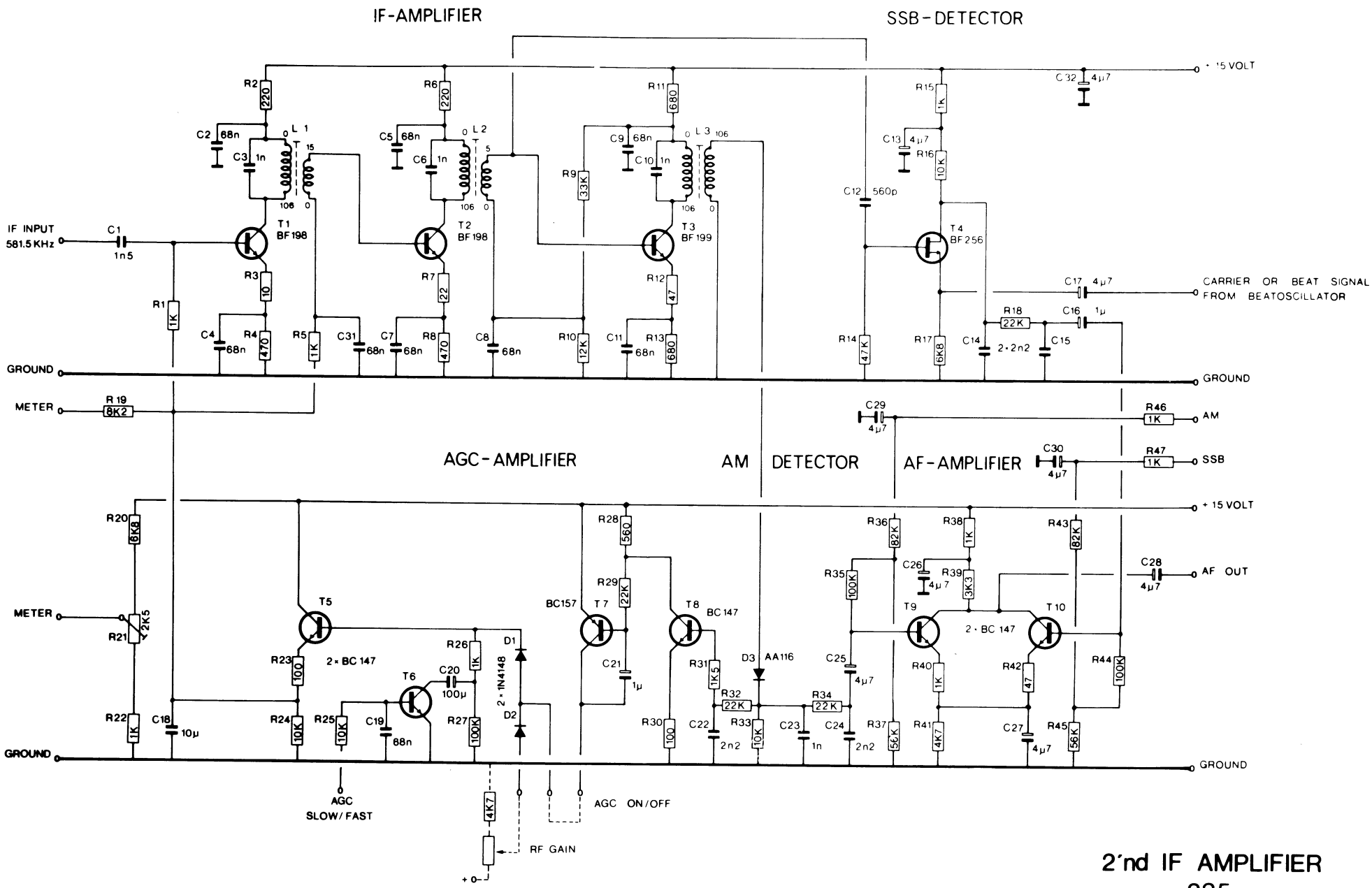


IF FILTERS AM/SSB
MODULE 02.0226



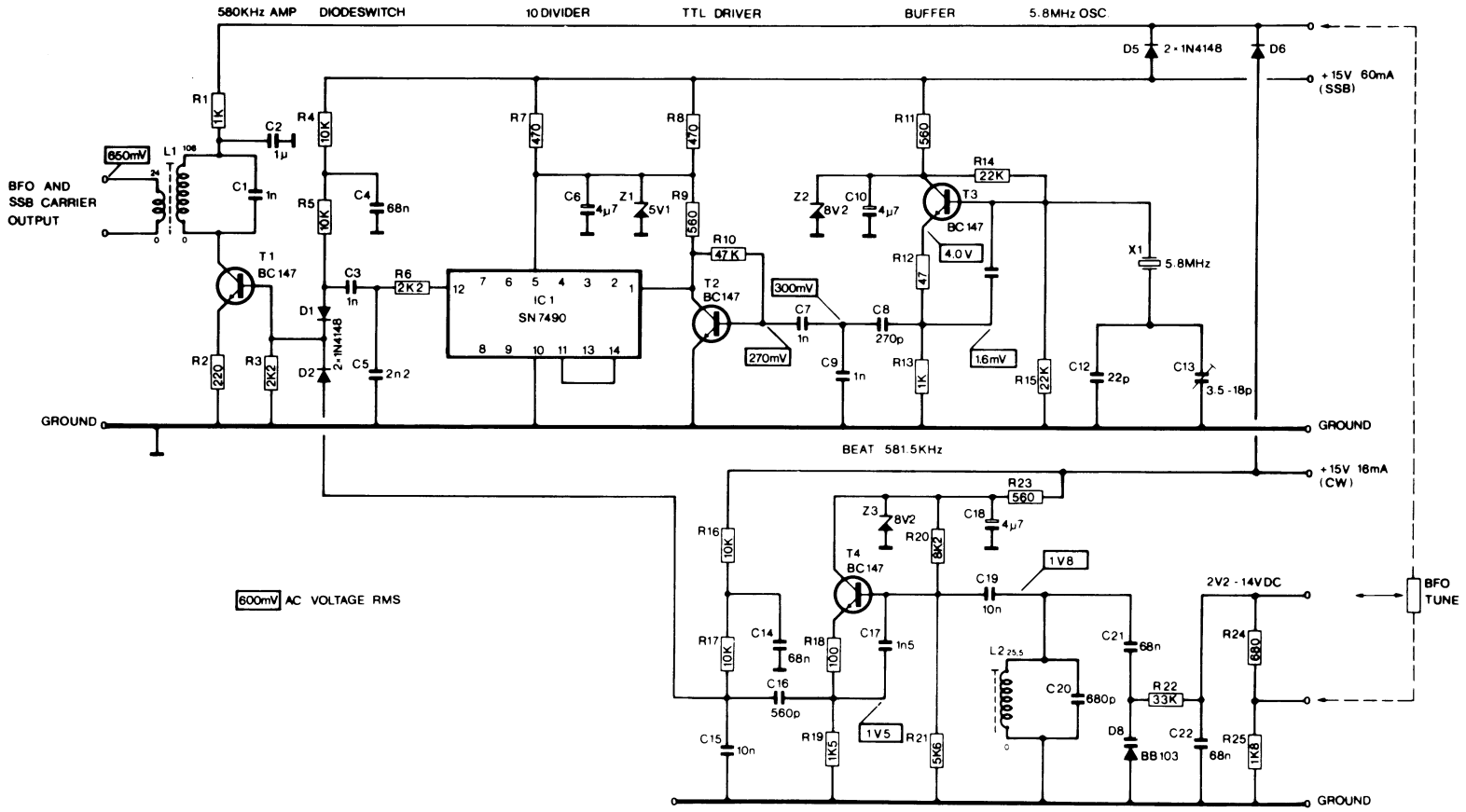
FIRST IF-AMPLIFIER MODULE 234

01.0251



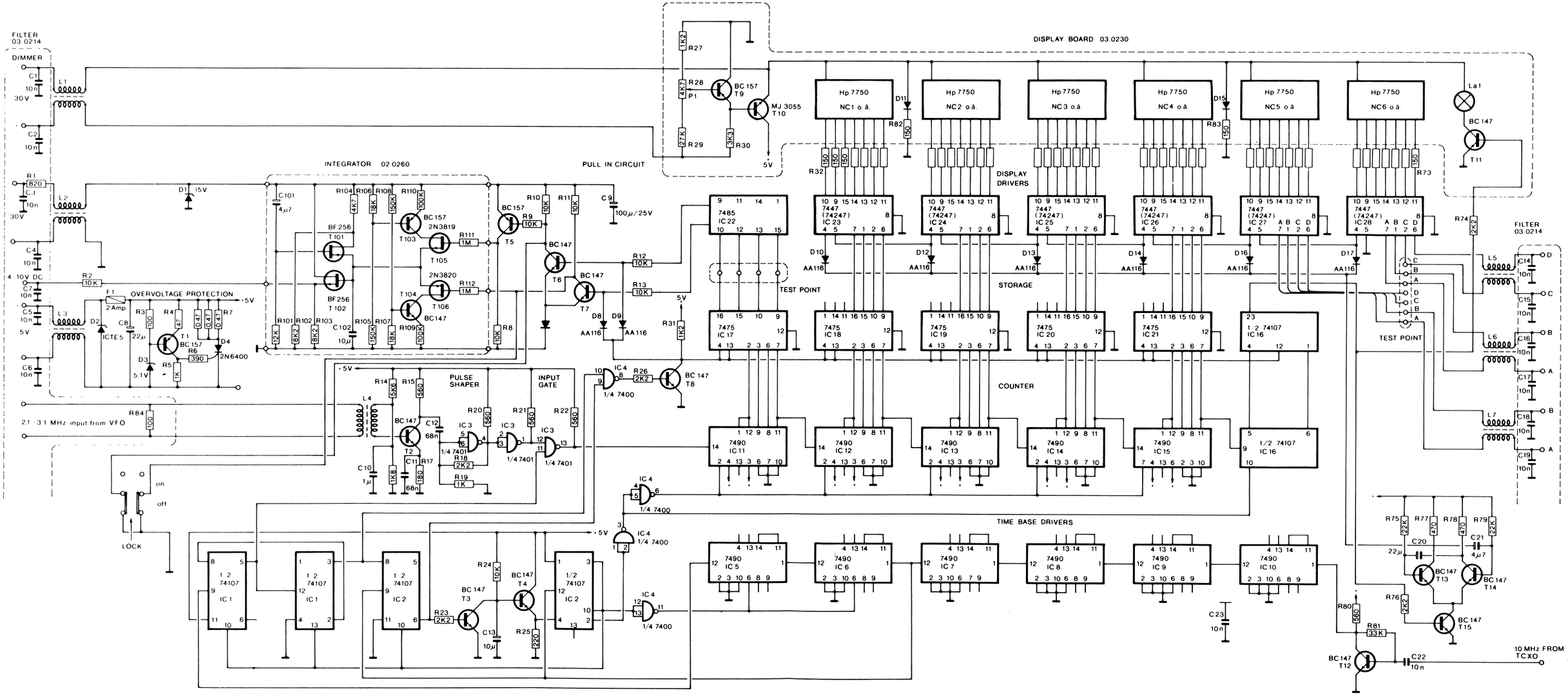
2'nd IF AMPLIFIER

235.



BEAT OSCILLATOR

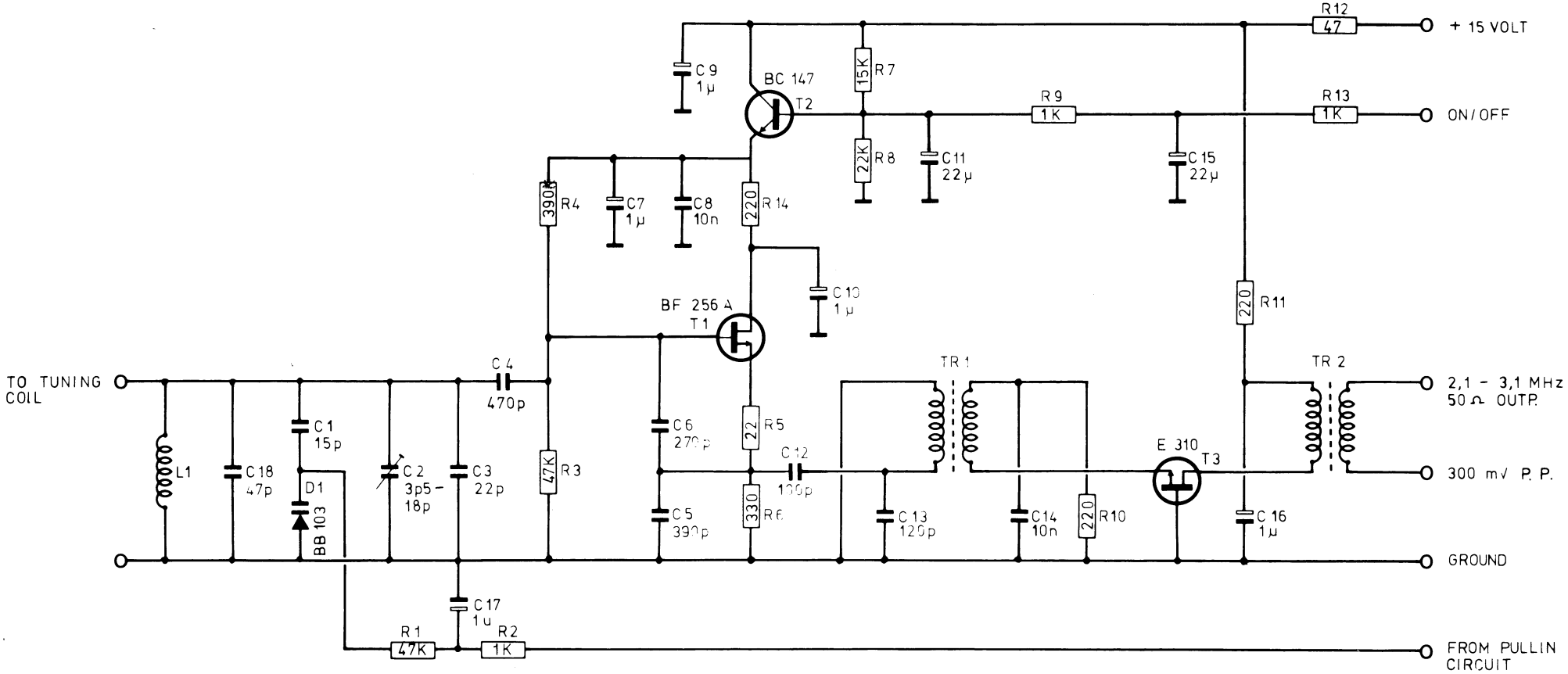
MODULE 02.0256



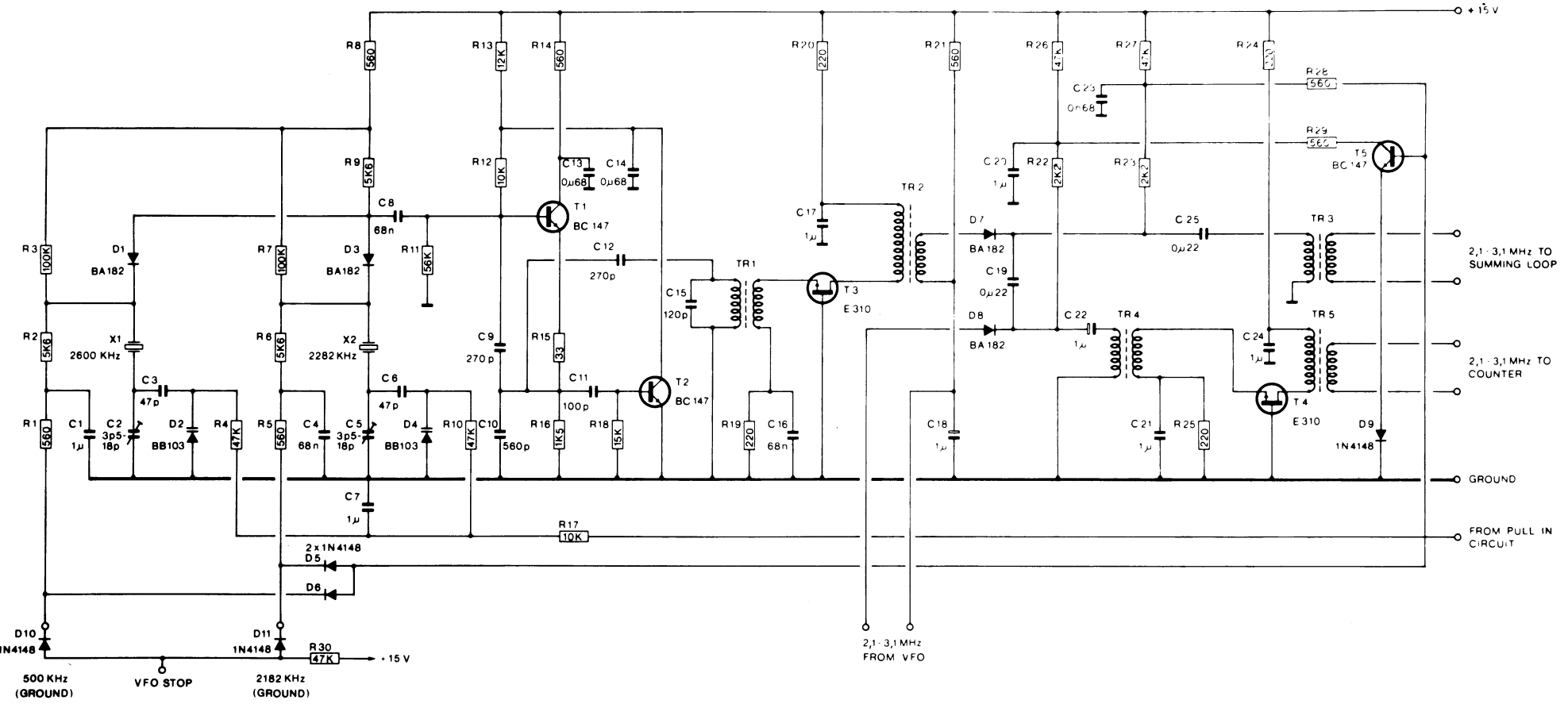
COUNTER & DISPLAY.

MODULE 233.

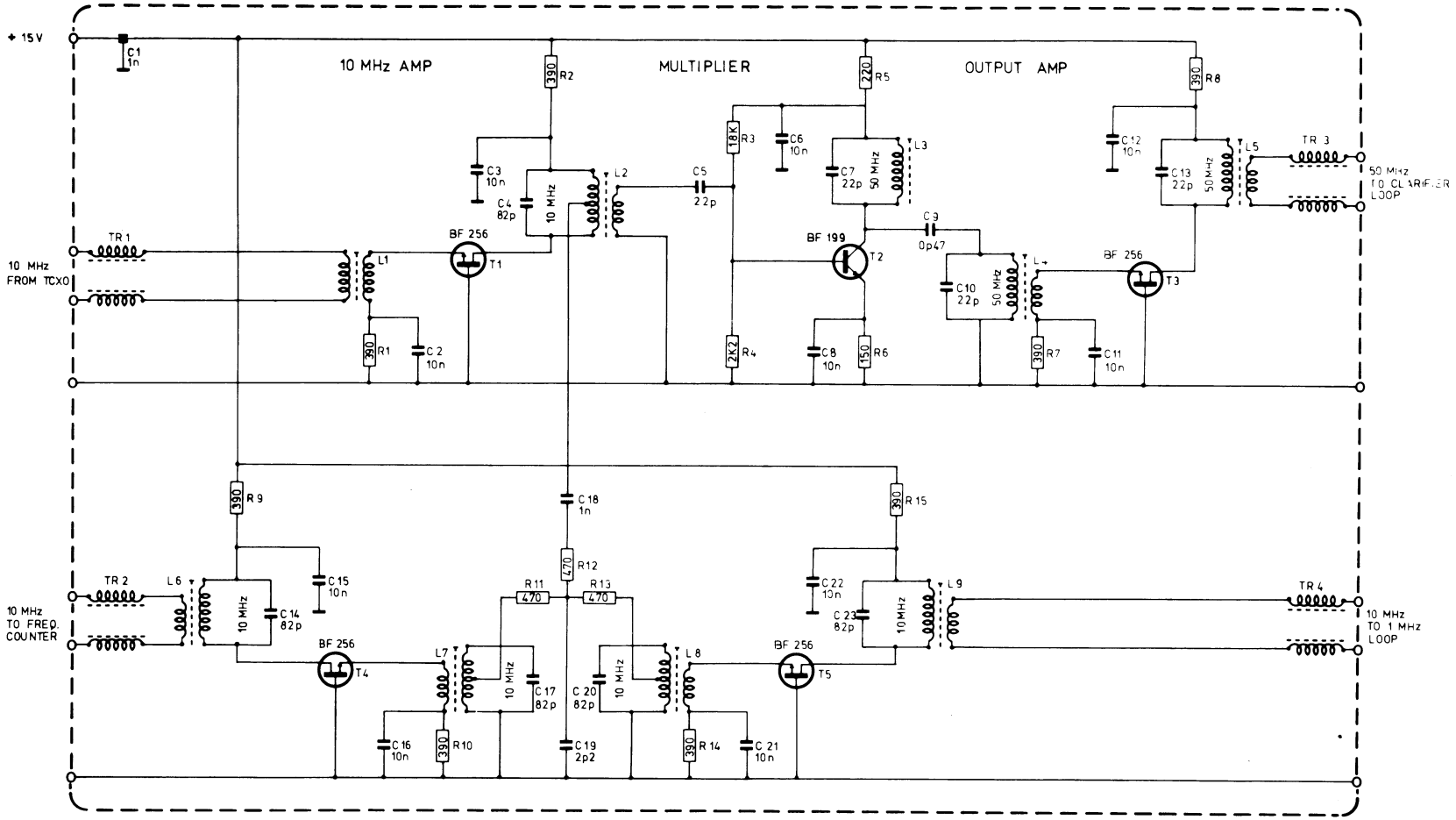
01.02 54



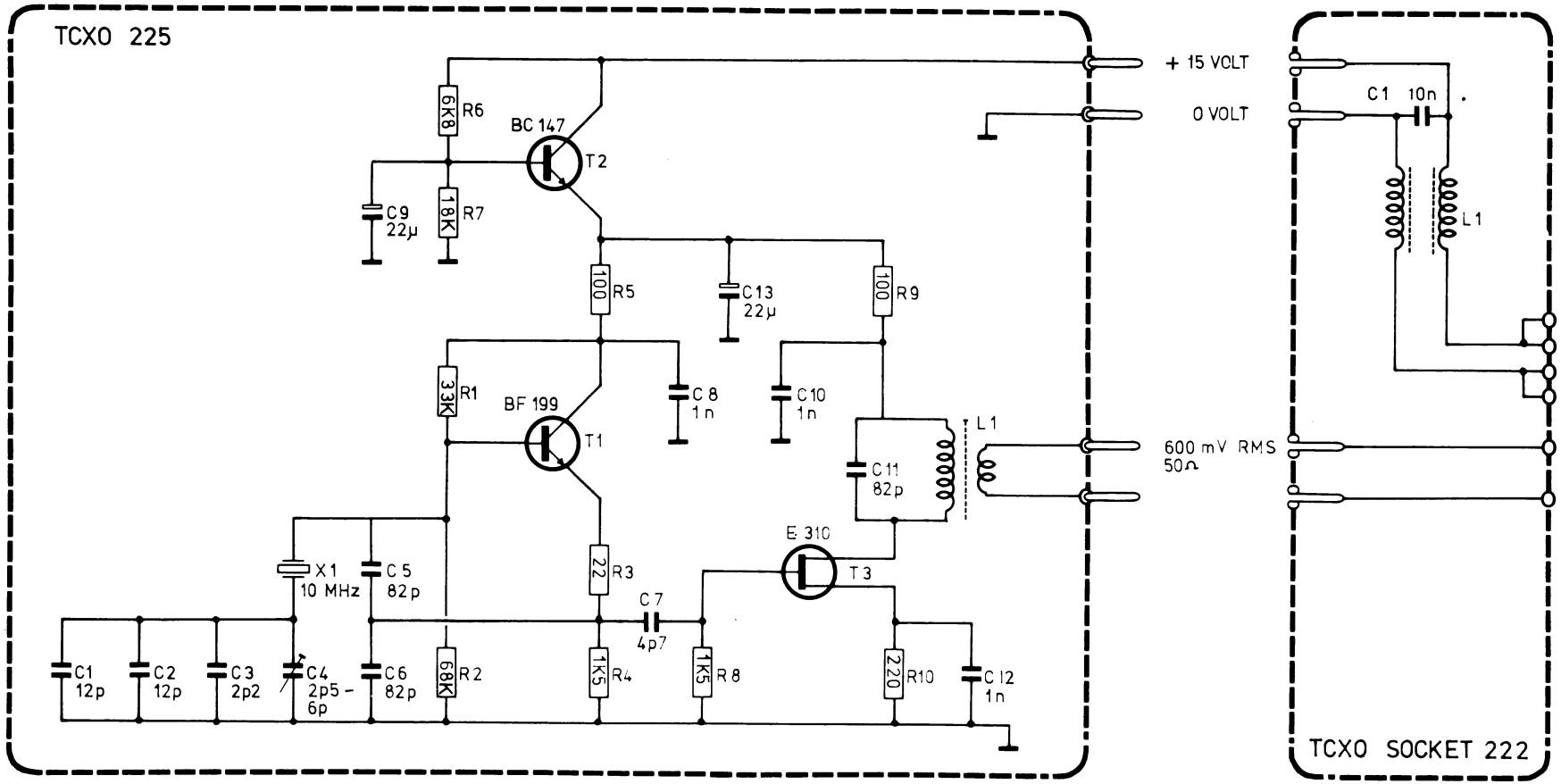
VFO
MODULE 232



DISTRESS FREQ. OSC.
MODULE 205.

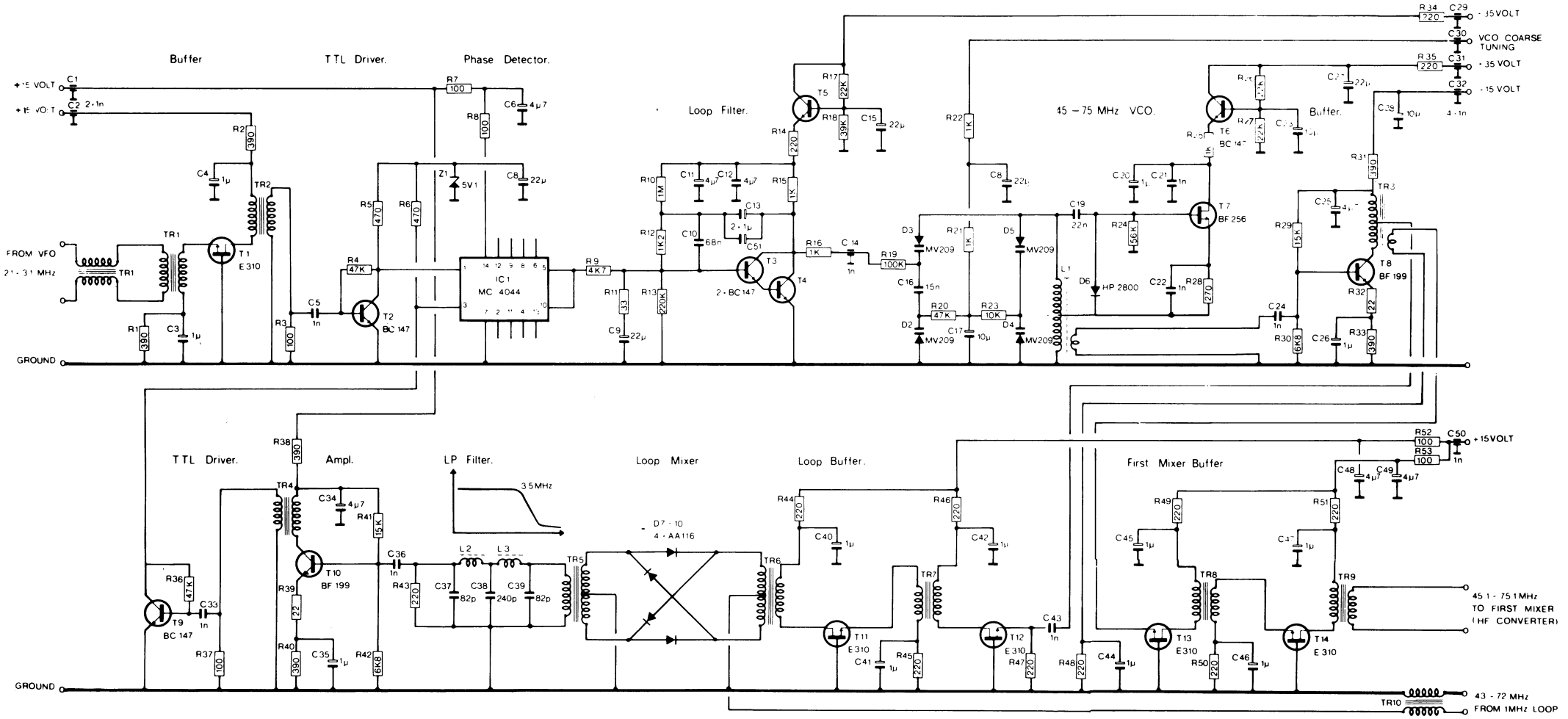


MULTIPLIER
R 201-3
MODULE 237



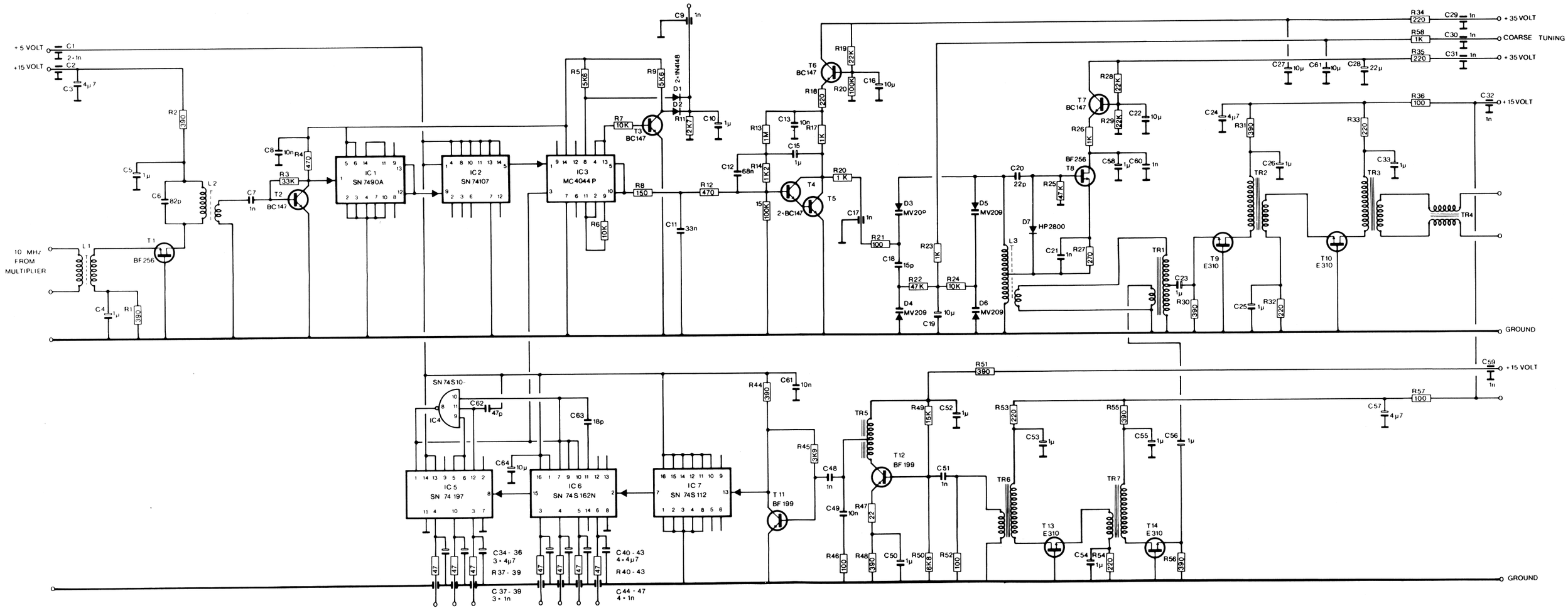
C1 AND C2 : TEMP. COMPENSATION CAPACITORS.
MUST NEVER BE CHANGED

TCXO MODULE 225
TCXO SOCKET MODULE 222



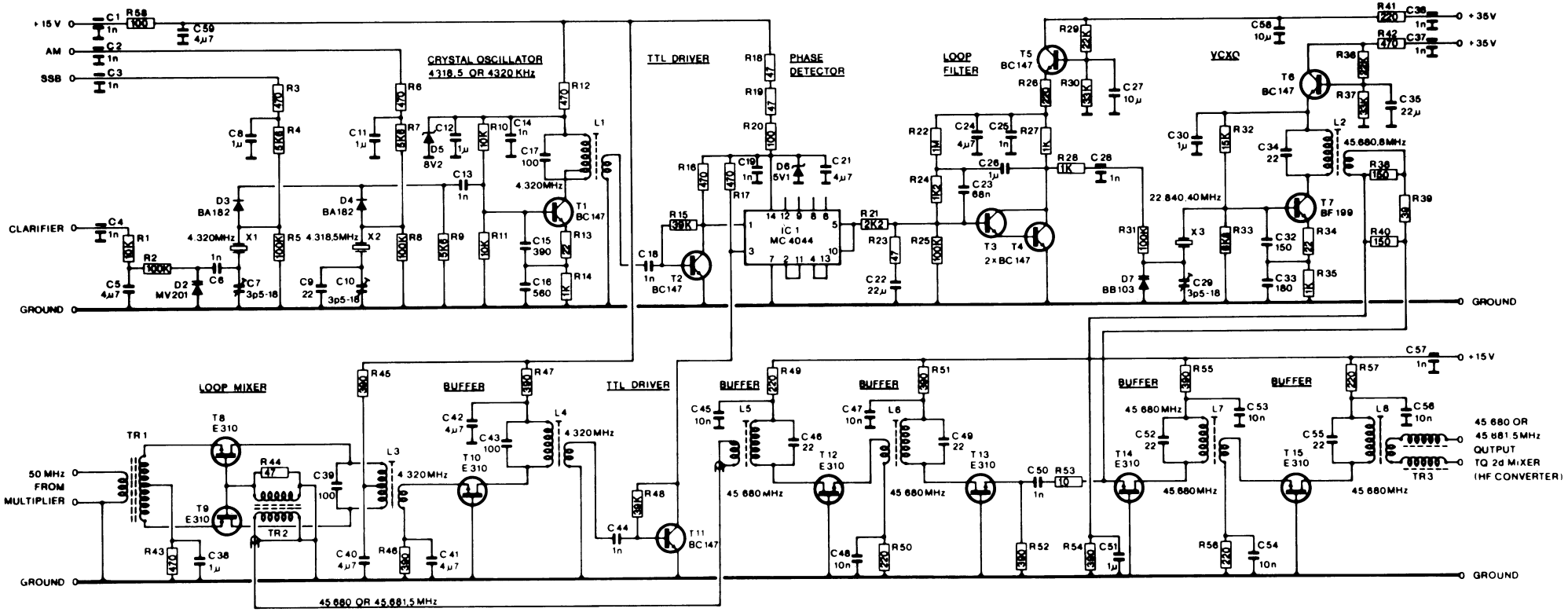
SUMMING LOOP

MODULE 020231

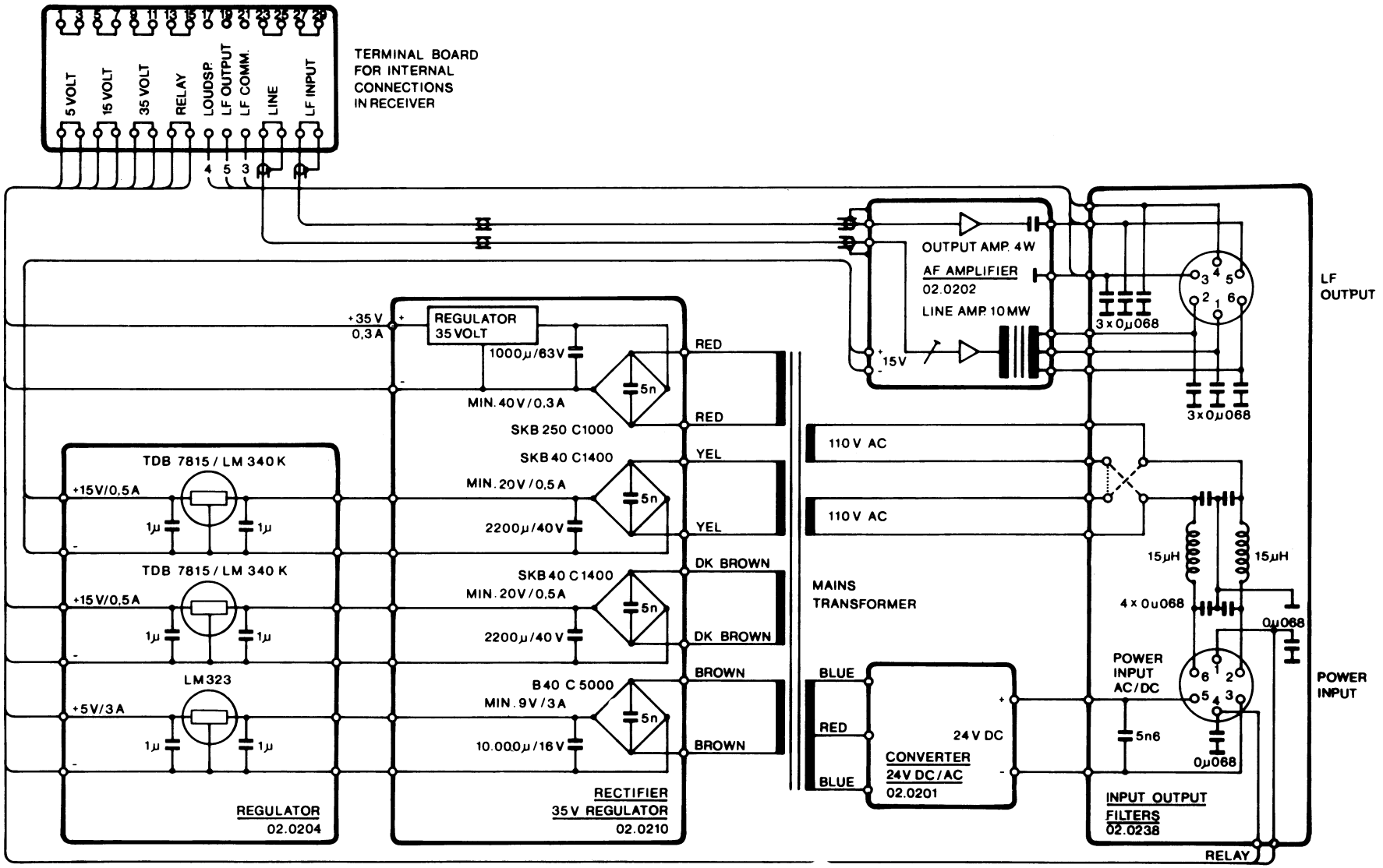


1 MHz LOOP

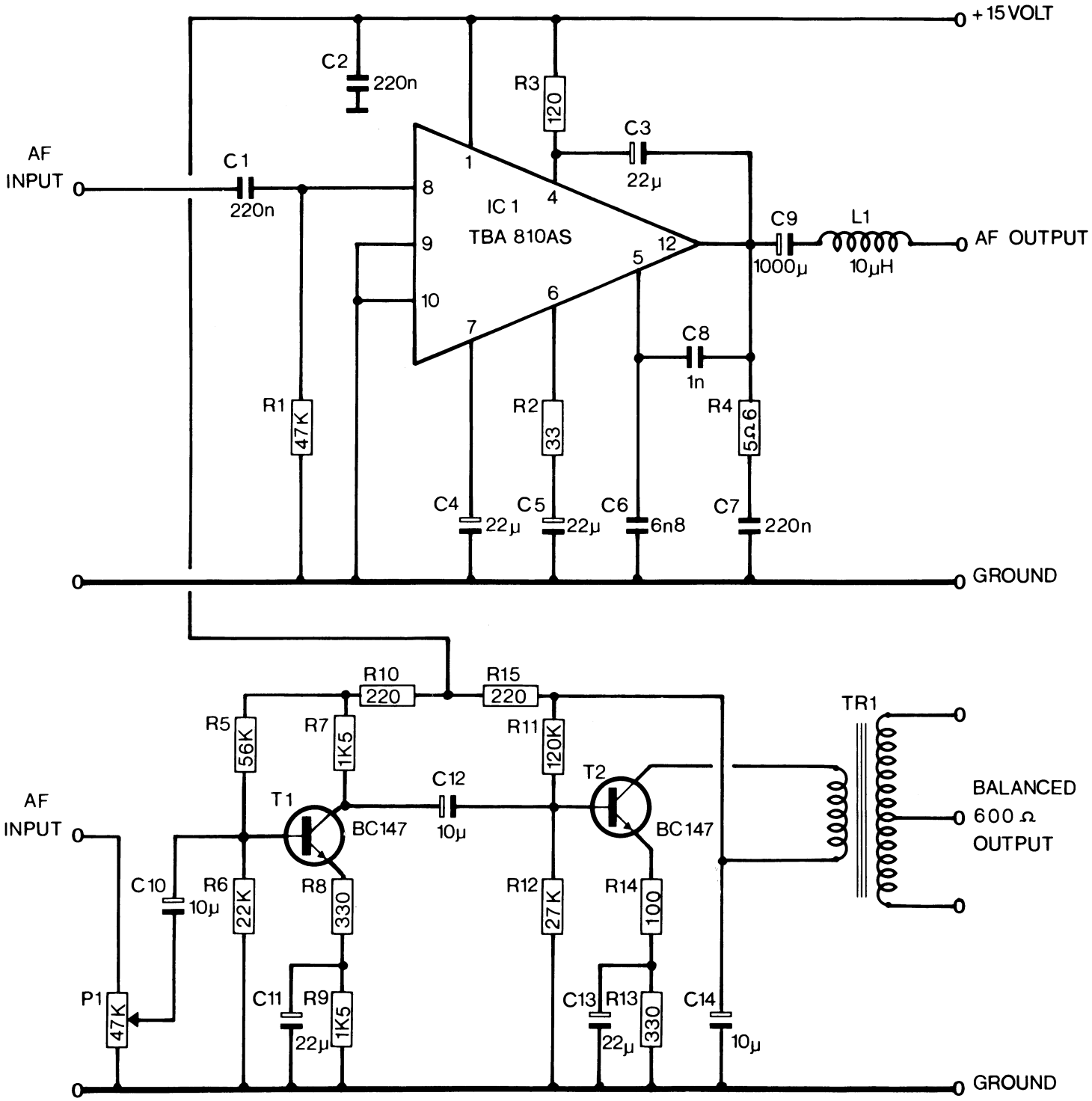
MODULE 02.0230



CLARIFIER LOOP 02 0229
FOR RECEIVER R 201-203
DRAWING NO. 10 0259

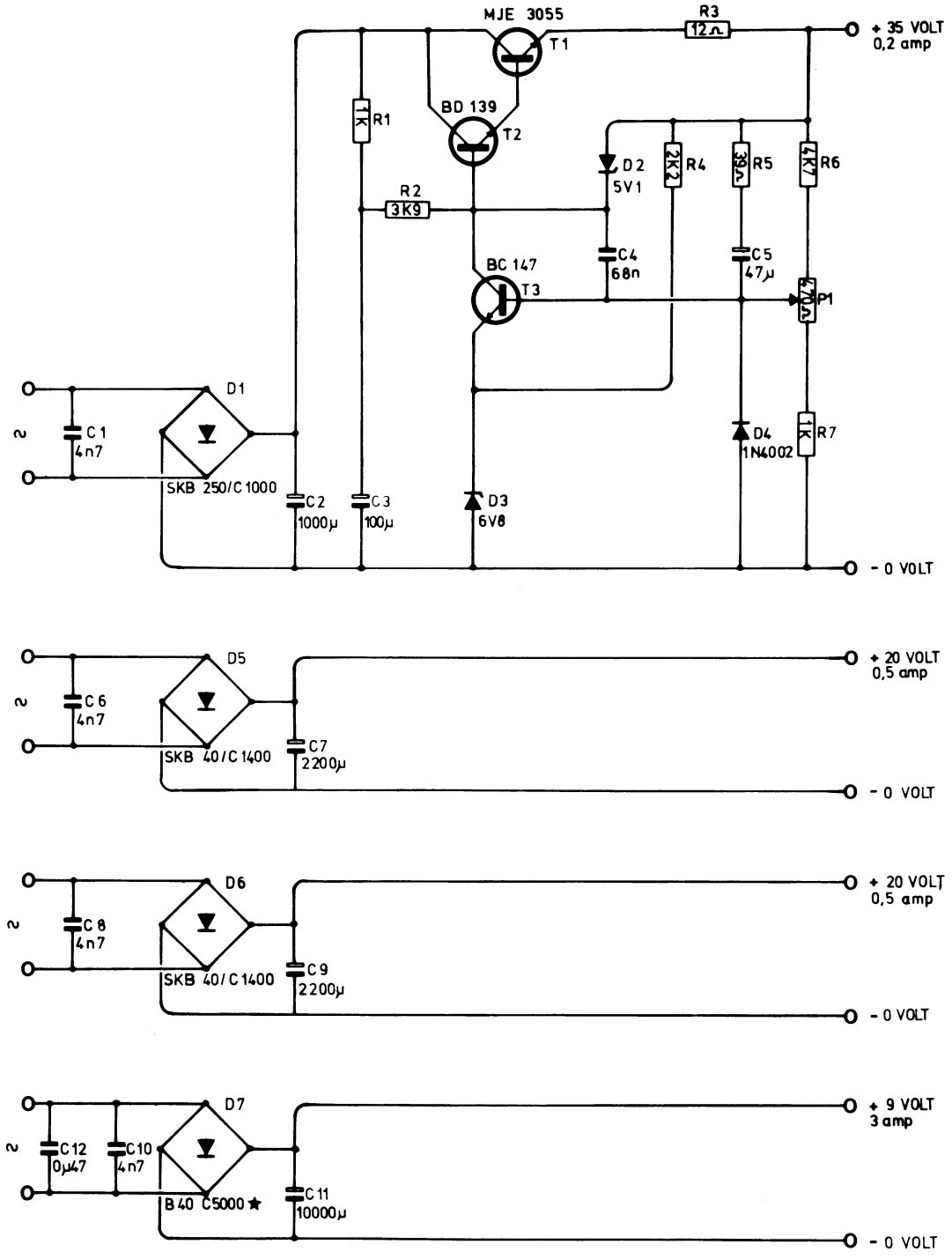


WIRING DIAGRAM FOR REAR PANEL FOR RECEIVER R 201-203



AF-AMPLIFIER MODULE 202

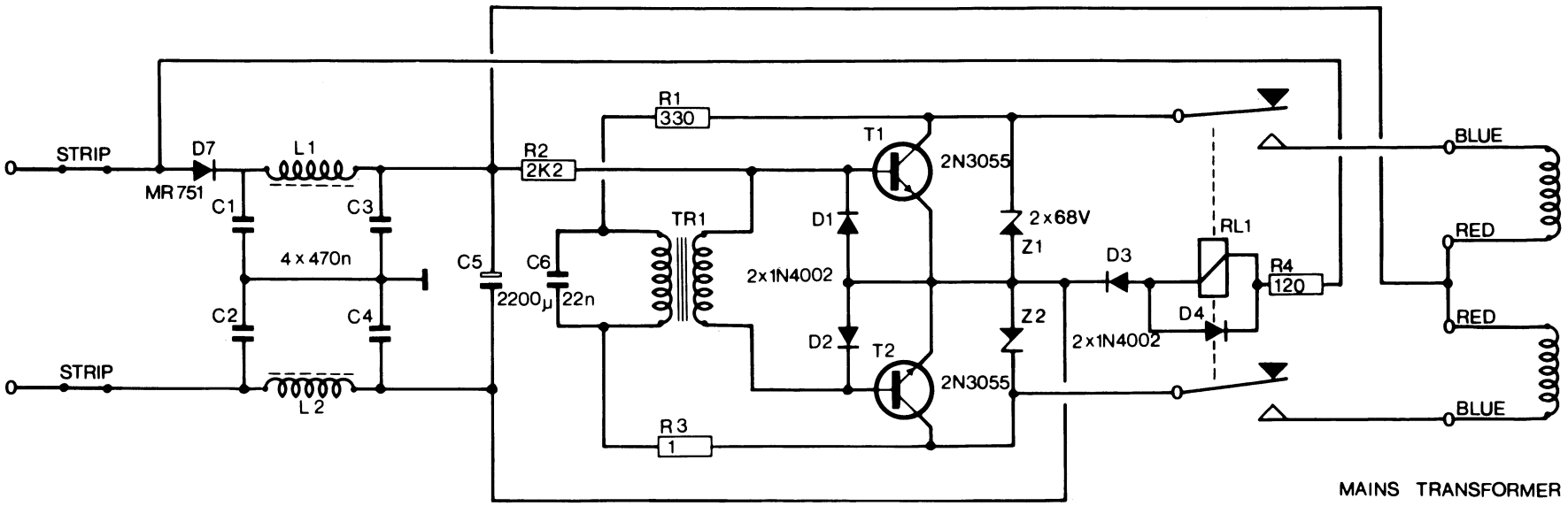
01.0261



★ NOT PLACED AT CIRCUIT BOARD

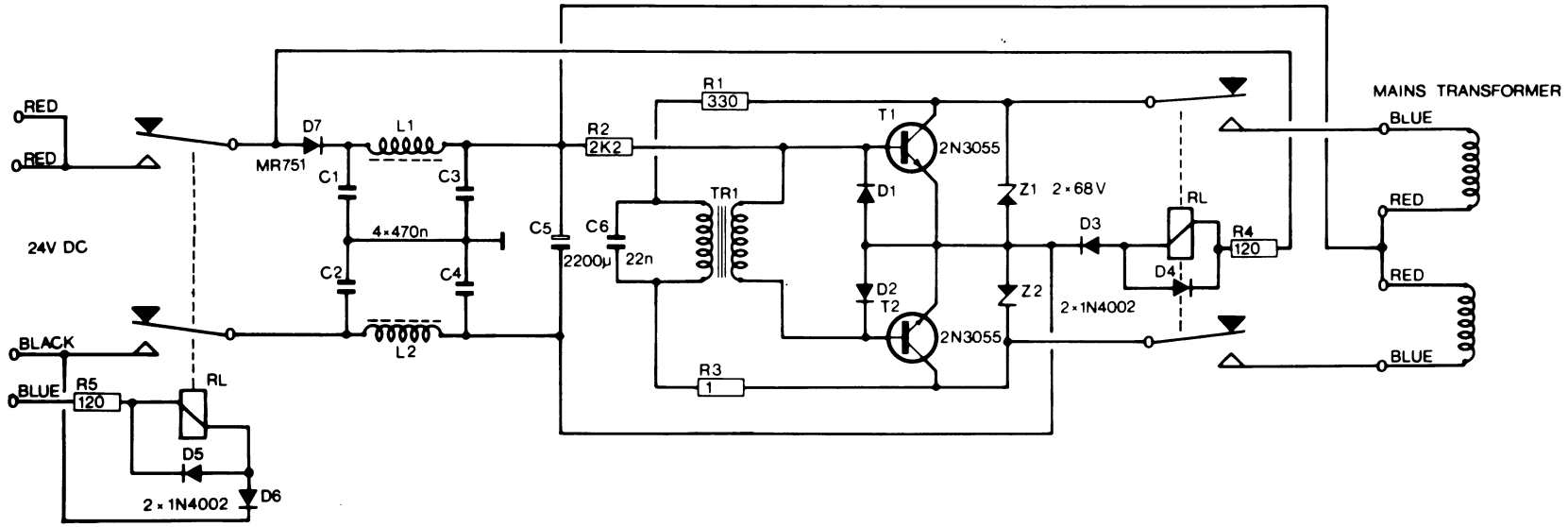
RECTIFIER 35 VOLT
REGULATOR

MODULE 210

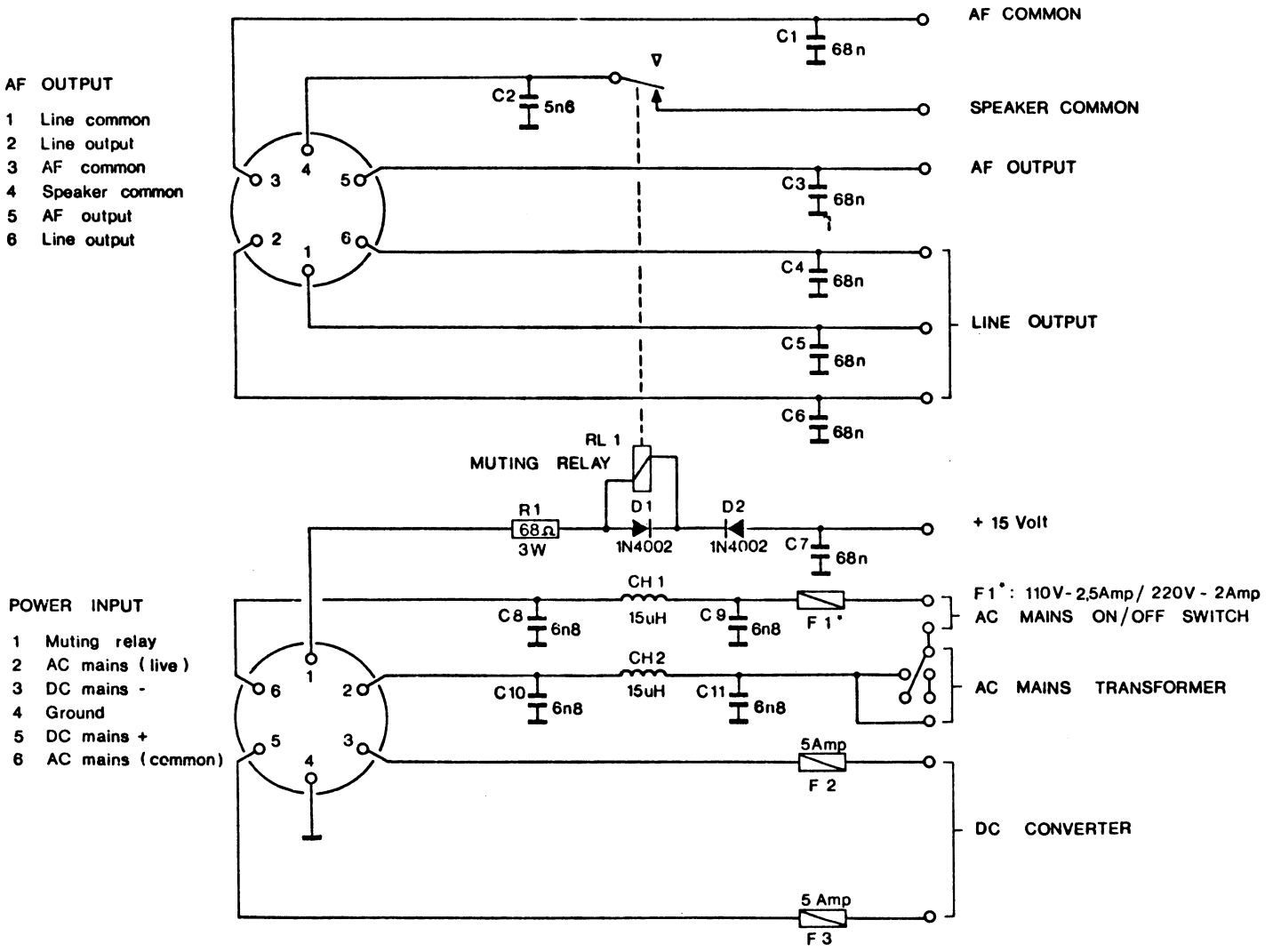


DC - CONVERTER

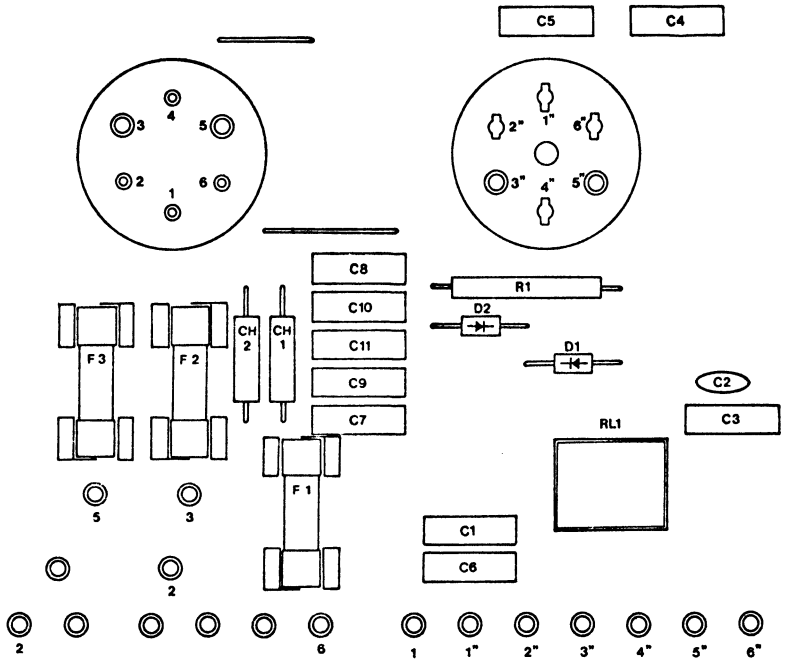
MODULE 201



DC-CONVERTER
MODULE 280



Input - output Filter.
Module no: 002.0238
Drawing no: 001.0263


C5
C4
3
4
5
2
1
6
2"
1"
6"
3"
4"
5"
C8
C10
C11
C9
C7
R1
D2
D1
C2
C3
RL1
F 3
F 2
CH 2
CH 1
F 1
5
3
2
C1
C6
2
6
1
1"
2"
3"
4"
5"
6"